RSP-0100

A Report to

The Atomic Energy Control Board of Canada

Regarding the

Performance Indicators Pilot Project

(Contract 98-166 "Performance Indicators for Radioisotope Licensing")

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Abstract/Résumé

HCA-Assessment Experts (HCA) is pleased to continue to be of service to the Atomic Energy Control Board of Canada (AECB.) In the current work, HCA was contracted by the AECB perform five tasks:

1) To assist with the Board's development of Performance Indicators,
2) To prepare and present a series of web pages containing a preview of a web-based application (subject to certain constraints,)
3) To survey Licensees and solicit their opinions about the web-based preview,
4) To assist with the Board's efforts to update their information pertaining to Licensees, and
5) To expand the original mandate of the Performance Indicators task to include those AECB staff whose job responsibilities link them to the Licensee's tasks.

Performance Indicators have been recognized by the AECB as central to providing an outcomes-based approach to performance management. HCA applauds the AECB in this regard and designed an integrated series of interactive web pages to facilitate acceptance of Performance Indicators within the radioisotope user population in Canada.

This report presents:

- A description of HCA's rationale for Performance Indicators. Discussion is presented about possible threats to the AECB's successful implementation of Performance Indicators. Central to these threats is the position of the AECB with respect to the radioisotope users and internal staff.
- A description of the web pages. The reader is "walked through" the attached CD. Discussion is presented relating to various Web-related topics such as security, HTML pages versus Web applications, on-line databases and the sharing of same, and the like.
- Summary results of the survey to Licensees. Overall, these results were very favourable regarding the Performance Indicators Pilot project, but a degree of distrust towards the AECB and its Inspectors remains.
- A brief discussion about the nature of the ILS data received from the AECB by HCA. This data was the basis for all subsequent Licensee faxes and was markedly out of date if not plainly incorrect in many instances. Accurate data in a web-based database or application is of paramount importance.
- A presentation of the work to date on the development of Performance Indicators for those AECB staff members whose work responsibilities overlap with the Licensee's tasks covered by the Act or related regulations.
- A series of recommendations from HCA to the Board.

The largest challenges facing the AECB appear to be those that determine how the Board conducts and shapes itself in the future. The Board has been a participative regulatory body that has also policed compliance. It should become a truly regulatory body that facilitates improved compliance. The ownership of the regulations and expectations for compliance must rest with the AECB. The ownership of client continuous improvement must rest with the client. Expectations that are not met must have ameliorative or remedial consequences.

HCA strongly believes in the future of the AECB. To meet this future, the challenges outlined herein must be ***successfully*** met.

Disclaimer
The Atomic Energy Control Board is not responsible for the accuracy of the statements made or opinions expressed in this publication and neither the Board nor the author assumes liability with respect to any damage or loss incurred as a result of the use made of the information contained in this publication.

Section One: Rationale for Performance Indicators

There is a simple belief that the tasks people have in their jobs should be done well. Most people also believe that the successful performance of those tasks have positive consequences. They are encouraged by this belief and it is supposed to motivate them. Greater effort leads to better performance and thereby, favourable consequences.

Why does this simple belief fail to be supported so often?

It fails because:

- People don't see a link between their increased effort and better performance ("No matter how hard I work, I won't get a better rating. I can't get an 'A.'")
- People don't see a link between their effort and consequences. ("Sure I get a better rating, but that doesn't mean anything.")
- People can't align their efforts with some criterion or standard. ("I don't know *how* to get an 'A' – the rules change or the Inspectors are biased.")
- People are promoted to higher positions without the attendant increase in responsibility for the outcomes of those loftier positions.

Often, people seeking promotion in terms of compensation and status actively pursue greater responsibility or more tasks. Ideally, we would like to see greater success met with greater (positive) consequences. Praise, increases in compensation, privilege, or status all come to mind when considering positive or exemplary work behaviour.

Conversely, a lack of success in one's tasks should bring another type of consequence – such as the requirement for additional training or the denial of access to some desirable item.

Yet the logical appeal of differential consequences for good and poor performance has been a stumbling block throughout most human performance management strategies.

People do not like to deliver negative feedback. They do not like to talk about poor performance. They do not like to have confrontation. In fact, people will go to great lengths to avoid giving negative feedback – real or perceived. Performance appraisals, for example, are fraught with rater biases that serve to reduce the conflicts and problems associated with negative feedback.

The problem is simple. The answer is simple.

The management of human performance is simplified when *all of the following conditions are met*:

- Give clear descriptions of the required criterion performance.
- Make performance feedback contingent and immediate.
- Provide feedback and performance descriptions using clear, measurable and behaviour-based terms.
- Provide criterion performance targets that are clear, measurable and valued.
- People will *value* the criterion performance targets when they believe that their additional efforts yield better performance, and that their better performance is accurately recognized.

Like the links in a chain, each of the above is as strong as the others. All are required for a successful human performance management system. In the case of the AECB, the Board has chosen Performance Indicators as their human performance management system. For the AECB's attempt to be successful, Performance Indicators must embody the items listed above. There is tremendous weight attached to the AECB's investment in Performance Indicators.

This importance largely springs from the idea that the AECB is standing at a crossroads. Its past and future are intimately tied to its ability to be an effective regulatory body. Historically, the AECB managed its radioisotope users by providing expectations for performance *vis a vis* regulatory documents. This thumbnail description is not intended to diminish the years of excellent work completed by the AECB. Rather, it is hoped that a focus might be brought to the fact that the AECB can make the linkages between its expectations for radioisotope user performance clearer. In doing so, the AECB could foster a new working relationship between the regulator and the users to whom it provides services and guidance.

Such a new working relationship should be based on a clear understanding of what is expected to meet standards, providing a means of assessing progress towards those goals, and a mechanism for making these successes at meeting goals self-maintaining. Moreover, the range of radioisotope users should be helped into a position wherein they assume ownership for their own successful ratings.

The AECB has chosen Performance Indicators to serve as the basis for developing this new working relationship. In part, the AECB's motivation for selecting Performance Indicators as an element of its organizational armementum comes from a renewed drive within publicly funded organizations to show demonstrable utility. Having specific, measurable and behaviourally based outcomes are a central part of Performance Indicators.

Yet a governmental mandate is part, not all, of the AECB's reason for adopting Performance Indicators. The monitoring of performance and the attainment of new levels of successful compliance can only come about when certain conditions are met:

1. Performance goals are expressed in concrete, behavioural and measurable terms
2. Feedback is immediate, contingent on performance and also expressed in concrete, behavioural and measurable terms
3. Participants value the performance goals
4. The goals are difficult but obtainable
5. All four elements above must be met in order for Performance Indicators to succeed.

An additional feature of Performance Indicators is that they embody the means by which the AECB can transfer the responsibility for higher ratings from the policing efforts of its inspectors to the day-to-day activities of the radioisotope users. When people who receive performance ratings are asked about what type of feedback they would like to receive, they report that they want feedback about *performance* not *personality*. Performance Indicators can accomplish this.

Performance Indicators can also foster the transition from policing and regulatory functions to facilitating improvement.

In short, the rationale for Performance Indicators is to bring about the improvement in radioisotope user performance (and likely the work performance of AECB staff members who are involved in radioisotope user matters.) They can do so in a non-threatening, non-confrontational manner that passes the responsibility to those being rated and not the regulatory agency.

This report describes the work to date in developing a prototype version of Performance Indicators, the responses from those who have seen and used this prototype and describes the likelihood of achieving the Performance Indicators goals.

These goals are not immodest. Nor are they intangible -- they are concrete and achievable. The degree to which these goals will be met are moderated by a few important factors. Some of these factors are described below. The reader who wishes to pass over these concerns is welcome to proceed to Section Two, a description of the prototype web version of Performance Indicators.

The brief discussion about factors that might hamper the success of Performance Indicators is meant to provide a balanced perspective. The feedback from visitors to the Performance Indicators prototype is overwhelming. People are very enthusiastic about the idea of having such a resource. This enthusiasm, however, will not be sustained without due consideration of the factors presented on the next few pages.

Factors Hampering the Success of Performance Indicators

There is no debate as to whether or not Performance Indicators have been sanctioned by the AECB. They have. There is also little debate as to the successful reception of the Performance Indicators prototype.

What remains to be seen, however, is whether or not the AECB can surmount the few remaining issues that may threaten the success of this new endeavour. Some of these issues are listed and described below. To be fair, these comments do not reflect *all* radioisotope users, just those who represent likely pockets of resistance to change in general.

These issues include:

1. "Shifting Responsibilities" (the tendency to shift the responsibility for performance to some other person, cause or agent.)
2. "A Previous lack of Clear Commitment to Continuous Improvement" (Wherein "getting better" has never really been an organizational priority.)
3. "Open Ended or Unlimited Feedback" (Wherein licensees are providing feedback *ad nauseum* and delaying the implementation of regulations or policies.)
4. "Licensee Perceptions" (These perceptions are widely supported within the Licensee population, and while their validity might be questionable, their pervasiveness is not.)

To summarize these points, a brief section detailing the subjective description of past evaluations is provided. This incorporates feedback from licensees and Inspectors across Canada.

1) Shifting Responsibilities...

There is a tendency for some radioisotope users to not accept responsibility for their own ratings. Some radioisotope users will (and have) laid blame at the feet of others. Citing such concerns as perceived rater bias, they shift their responsibility for their earned ratings or poor performance to others.

Sometimes the blame is used to shift responsibility to their organization ("I don't get enough money, time, staff, etc.")

More often, the AECB itself is the target of the blame. When this happens, these same users tend to remove themselves from the accountability loop because they view the desired goal as unattainable. "If I can't get there, why try?" might describe this group. They will have failed to meet the "difficult but obtainable" facet.

2) A Previous Lack of Clear Transition to Continuous Improvement...

The AECB should make a clean transition from a participative regulatory body that also happens to police users to a body that sets the regulations and facilitates continuous improvement. Ownership of the regulations, as well as the definitions of compliant behaviour, seem to have two owners – the AECB and the users. Ownership of the regulations and compliance rules should reside solely with the AECB.

This "sole residence" of the regulations, expected performance levels and compliance rules will foster continuous improvement in the licensee population when those rules have been made public. This shares the standard, but does not give away ownership of that standard.

3) Limit Open-Ended or Unlimited Feedback...
If the AECB is indeed to make the above transition, it is suggested that the Board proceed directly with its implementation of Performance Indicators. The Board *should* solicit feedback (as it has done in the current project) but not impede or delay that implementation with encumbrances such as overly long discussions with stakeholders. There is no suggestion that the Board be draconian by being unilateral, but only to humbly suggest that the regulatory body is not a court of public opinion.

In the past it would appear that licensees and other stakeholders may not have availed themselves of the opportunity to provide feedback in a timely manner. If a time limit for participation has expired, it has expired. By the same token, the AECB might increase its presence at venues that attract licensees and stakeholders. The AECB, in all likelihood, cannot be everywhere, at all times, to listen to all people, in an unlimited manner. But, it can advertise its "open ear" at relevant conventions, association meetings, and the like.

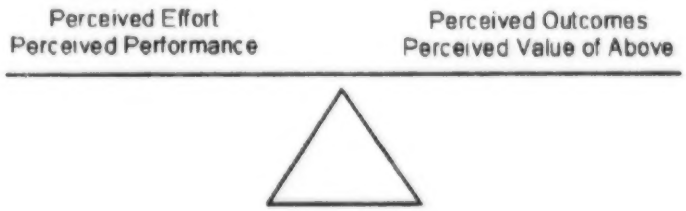
4) Recognize Licensee Perceptions
It may be, that in the development and maturation of the AECB, that its members have lost some awareness of the perceptions of the radioisotope user population. What many longer-tenure inspectors have described as a more amiable working relationship with radioisotope users would appear to have given way to a less amicable working disposition.

This is not intended to sound dire. HCA's direct communications with many radioisotope users would indicate that the majority view Performance Indicators as a means of finally understanding (and thereby improving) their AECB ratings. Yet, the perceived subjective nature of the AECB evaluations remains an important element and is presented in greater detail, below.

A Subjective Description of Past Evaluations

This section has been titled as "subjective" to underscore the important role that perceptions play in the realm of compliance behaviours. As well, people *will not be compliant* if their perceptions and subjective opinions lead them to conclude that compliance will be for naught.

Figure 1. Balanced Perceptions.



Social Psychology has a model for addressing motivation and compliance called the equity model. In this model, we are told that peoples' perceived outcomes and the importance of those outcomes must balance peoples' perceptions of their efforts and behaviours. When these two sides balance, people will be compliant. If people believe that increasing their efforts or contributions will lead to no increase in some desired outcome, they will not be compliant.

Many radioisotope users within Canada have a somewhat negative, if not hostile, view towards their radioisotope inspections and the agency that drives those inspections. HCA wishes to make very clear that this is a *perception* amongst many users and *not* a statement of fact. These perceptions, however, do colour descriptions of past evaluations in the eyes of the radioisotope users.

Radioisotope users will often describe Inspectors as providing arbitrary and unreliable ratings.

Our conversations with these users indicate that even though they think Performance Indicators will certainly help them do a better job, they *also believe* that Inspectors will likely continue to make biased ratings. This *perceived* bias is discussed briefly below.

Perceived Bias in Inspectors' Ratings
As in all other cases wherein ratees blame the raters for poor ratings, the issues lie not within the domain of the raters, but with the means by which those ratings are generated. No one likes being evaluated by underdefined criteria. They like it even less when career, compensation or punitive decisions hinge on those ratings. As a consequence, the ratees tend to cast the raters as responsible for untoward outcomes, frustrations, and even systemic bias.

It is acknowledged that not all raters make perfectly reliable ratings at all times. Inspectors must live and work in a real world that is error-prone. However, the perceived bias is a function of the poorly defined criteria and expectations and not the raters.

This perceived bias can only be addressed and resolved by showing that all parties in the evaluation process are bound by the same rules. Performance Indicators will bring this about. Thereafter, the AECB has a period of time (perhaps up to two years) for the message that "everyone is working from the same rulebook" to take effect. The two-year period is suggested because there is a strong perseverance effect when considering the attitudinal change within a workplace. During this time, there is a risk that those who initially accepted the new program will suffer from a form of recidivism – they place great importance on immediate change and when *immediate* change fails to appear, they revert to a more entrenched and negative view. Simply put, they're disappointed when their high expectations are not met.

The Nature of the Radioisotope User Population
The radioisotope user population is ***not*** more negative than any other group of people or employees. They share a common set of concerns that come to the fore whenever questions of performance evaluation are raised.

It was instructive to use the example of annual performance appraisals in meetings with inspectors and LAO's. Nearly everyone agreed that the forced distribution of rating grades prevented all of the high scoring individuals from receiving their high score. They understood that this rating error had an effect on them personally. Similarly, they admitted (nearly to the person) that performance reviews were akin to an "annual dread day!"

Without likely acknowledging the direct similarity between their views about being rated, the inspectors and LAO's voiced the same opinions as the radioisotope users! The point is this: The criticisms are generic and belong to a poor system of performance evaluation. It is unfortunate that the Inspectors are being viewed poorly when they only *bring* the "bad" news.

The messenger is blamed, as are the methods by which the news was delivered. This too, is typical.

People in general do not possess an in-depth knowledge of performance ratings, rating biases, or the assessment of human performance. They see the results that are applied to them. Again, in this regard, the radioisotope user population is no different than any other group.

The best means by which to resolve this matter is clear. The expectations for compliant behaviour must be made clear, measurable and shared amongst all parties. No one has an exclusive interpretation about what is measured. The implied question of "Who measures what?" is addressed below.

Who Measures What?
This is a question that has been asked of HCA innumerable times during this project. Inspectors and LAO's have asked us what the radioisotope users are measuring. Similarly, the radioisotope

users have asked us about what criteria the inspectors are supposed to be using. The core of the issue here would appear to be the historical ambiguity surrounding the ratings themselves. This ambiguity needs to be addressed as a systemic matter within the AECB, but needs to be addressed in a manner that is face obvious to the larger population of stakeholders.

In essence, HCA was charged with the responsibility of showing that the AECB will be more direct with respect to ratings and with showing that this might accomplished in real world terms.

A Two-Pronged Attack
This approach has been described as a "two-pronged attack." We are addressing both the assessment issues involved in the rating of human performance and the task of providing a realistic preview of what such an application might look like.

The beginning point of any discussion about rating human performance is the description of behaviours that are required for success on the job. This information is the product of a job or task analysis. Initially, HCA believed that the AECB had such information for Inspectors and for the entire list of use types. Indeed, a reasonable assumption was that the Inspectors had a set of SOP's (Standard Operating Procedures) for their ratings and that licensees and permit holders had their equivalent forms of these SOP's. Such was not the case. In the sections below, we present a brief discussion of the assessment issues and the web (demonstration) pages in the next section.

The Assessment Issues

A Lack of Clear Definitions
Again, assessment begins with clear definitions of the behaviours required for success. It is extremely important to note that these descriptions were not present within the AECB. While this fact represents an excellent starting point for the further maturation of the AECB, it also means that a significant piece of the project was not available. As case in point, HCA received only a few inspector rating sheets at the start of this project and towards the end of the project was forced to wait for the arrival of draft checklists from AECB staff.

HCA communicated with a wide and diverse set of people to build a set of clear definitions. HCA placed calls to licensees and permit holders to RSO's, presidents of organizations using radioisotopes, schools that taught or certified for various radioisotope usage, AECB staff, and the like. The result of these calls was the conclusion that everyone claimed to be working as hard as they could on meeting their AECB compliance goals. However, the lack of clear definitions significantly hampered further success. In a number of instances, this lack was described in conversations that dealt with the letter grade ratings. People were not told what they had to do to get an "A," and were often told that getting an "A" would be an impossibility. Others made note of the fact that other grade values were multiply determined and they could not know how the received grade was established.

Again, these are the perceptions of the AECB's client group. Some of this confusion about rating definitions might be assuaged with the newer grade ratings and breakdowns. There are to aspects of the new scheme in particular that have impressed HCA. The first is that a "D" rating might no longer mean "many (small) 'B' ratings" and the new rating of failure has been added.

An Absence of SOP's
Pursuant to the above, it became clear to HCA that the AECB was operating without formal SOP's for many inspections and ratings. Inspectors do work earnestly to provide fair ratings by reviewing their respective sites and appeared to have adopted a "top-down" inspection heuristic. They would implicitly weight their ratings by the tenure of the client, past ratings, areas of past success, and the like. Thereafter, the inspectors would pay less critical attention to areas that enjoyed higher ratings and concentrate on areas of performance with lower ratings. Inspectors were doing the right things, but in a very idiosyncratic method.

As in a Pareto diagram or analysis within a quality control discussion, inspectors were beginning with the biggest problems first and working towards the next "biggest" problem (read "Gap between expected and actual performance.") While this makes logical sense, consistency is lost when all raters are not sharing the same evaluative criteria – the SOP's.

Licensees and permit holders express valid chagrin when one inspector generates a high rating and another a lower rating when the site is effectively the same. Moreover, when licensees and permit holders posed questions about how they might achieve improvement, they were directed back to various regulations and documents. While these regulations and documents are centrally important, a compliance "how to" or continuous improvement guide is obviously lacking. Posting of a sign, for example, would seem to have as many "best ways" as people offering opinions.

An Absence of Recommendations for Continuous Improvement
It appeared (at least on the basis of self-reports from licensees and permit holders) that any recommendations for continuous improvement were solely contained in the regulations and official correspondence. This commonly held perception among the AECB's client base apparently left them feeling as if they had no mechanism for improvement.

Inspectors have expressed trepidation about "interpreting" regulations and official correspondence. To overcome this reluctance, and avoid the perils of having outside bodies actively interpret the rules, HCA asked inspectors and LAO's for hints and tips about performance. To have been drawn from those in the client base that were already successful, HCA wanted to provide a short text description of how another client successfully met a challenge. We know that passing along descriptions of similar successes in an organization is motivating and breaks down the "I can't do that" and "Not invent here" barricades.

HCA asked inspectors and LAO's for these success stories so as to populate a hint or tips dialog box for all possible rating items. In fact, a number of the ratings items were to be drawn from exemplars of successful compliance. To date, HCA has not received a single item – despite repeated requests by voice, e-mail, in person and in conference calls. As consequence, HCA pressed forward and developed hints and tips that were culled from various regulations and official correspondence as well as our best "common sense" solutions to pressing compliance issues.

Expanding the Roll: Including AECB Staff
While this section is a slight departure from the content above, it deserves discussion within the "assessment issues" section. The AECB made the correct and prudent call to include various AECB staff positions in the Performance Indicators tableau.

First, it demonstrates the AECB's commitment to Performance Indicators in a manner that can be readily seen by the AECB's client base. In effect, it provides a "bragging right" for the Board's intention to bring a serious implementation to all of its stakeholders and not just roll out a project for the licensees and permit holders.

Secondly, it serves as a *de facto* statement for the AECB's intentions for its own continuous improvement.

In an attempt to determine which AECB staff were immediately involved in MRD's tasks involving radioisotope users, HCA was referred to a document containing business functions, policies and process numbers. We identified a number of AECB staff who are apparently involved in such tasks. In the final analysis, HCA derived sixty-two separate performance indicator requirements. This represented one performance indicator for each instance of a given staff job with each given process. This number is likely a conservative value since each staff member can appear more than once in each process.

Nevertheless, HCA created sixty-two sample web pages containing overall ratings for the staff-process combinations. Please note that in a proper web-based application (i.e., not demonstration web pages) the number of these staff-process combinations would be reduced so as to include all tasks performed by a given staff type. The rater would then select those tasks actually being performed by the target person.

It has been proposed by HCA that a separate project be initiated to deal with the Performance Indicators for AECB staff. HCA would need to collect more job and task analysis information about AECB staff jobs, determine which jobs are to be included, define specific behaviours for success, and the like.

In the interim, and to fulfil the expectations of the current assignment, HCA has created a set of 62 sample pages with each containing ratings pertaining to AECB service dimensions and the awareness of "upstream" and "downstream" responsibilities. "Upstream" referring to tasks (and the awareness thereof) that are effected before reaching the staff member. Similarly, "downstream" tasks are the ones performed after the staff member has completed his or her task(s).

The discussion of assessment issues is concluded here. The description of the second of the "two prongs of attack" is presented in the next section.

Section One Summary

- This first section has stated that the response from the licensee population has been very favourable.
- The AECB's commitment to Performance Indicators is apparently sound.
- The considerations listed herein have been aimed at strengthening the merits that exist at this point. The importance of recognizing licensee perceptions and the timeline for the change of these perceptions has been presented.
- The issue of perceptions, and other possible impediments to Performance Indicators need to be addressed.

Section Two: Development of a Web-Based Prototype

HCA bore a dual responsibility within this project – to derive a set of Performance Indicators for a select number of use types and to develop a prototype that might be viewed on the Web. The URL to start the Web-based prototype for local viewing is provided below. Please place your Pilot CD in the CD drive of your computer.

- If your CD is drive "D:\" d:\passfail.htm
- If your CD is drive "E:\" d:\passfail.htm
- If your CD is another drive, please open that drive letter and click on "passfail.htm."

Or, you may insert the Pilot CD and it will run itself, with a special utility placed on the CD by HCA. The utility will cause the first page to load into an 800x600 size screen (default SuperVGA format.)

The purpose of this section is to familiarize the reader with the navigation and logic of the Performance Indicators prototype pages. **Navigation** – in terms of moving from page to page within the prototype. **Logic** – in terms of understanding how the Performance Indicators were developed.

It was decided before the start of this project that the AECB's client group (licensees and permit holders) should see an example of Performance Indicators. The Board also likely understood that the development of any larger-scale computer application would demand greater time and resources than a prototype. In light of this understanding, HCA was asked to provide a realistic working model or prototype of a Performance Indicators application.

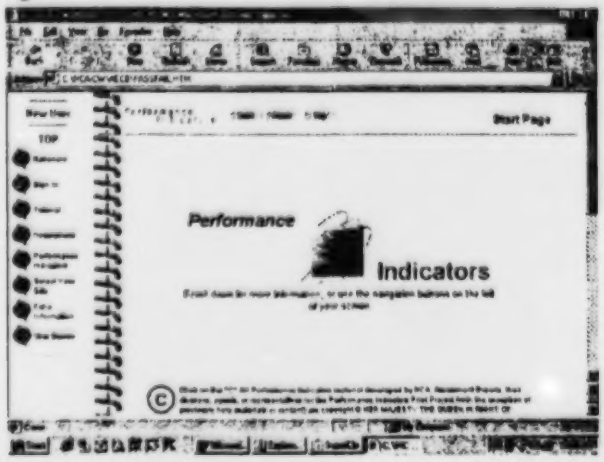
Subject to a small but important number AECB constraints. HCA created a large set of interconnected web pages. It was our aim to present a series of views as to the possible appearance a web-based application. Another of HCA's aims from the start was to include as much functionality as possible. Where we could not actually show a function or feature (subject to given project restraints) we wanted to show how such a function *would* work.

The terms "Web-based application" as opposed to a series of Web pages with some interaction ability are sometimes confusing.

- A Web-based *application* is loosely taken to mean a program that runs on the server computer and is "run" or accessed by the users across an Internet connection. Moreover, this meaning also includes the look and feel associated with Web pages.

We will provide some discussion about Web-related topics, but later in this section.

Navigating the Pages



The image above is a screen capture from a locally-run version of the Performance Indicators prototype. It shows the main start page, reached after the guest has passed from the splash screen with the AECB logo. This page allows the guest to select from several options:

1. View a rationale for Performance Indicators
2. Sign in
3. View a tutorial
4. See descriptions of Performance Indicators
5. Select a given Performance Indicator from a select list
6. Select a site from within Canada
7. View extra information
8. See the user survey

By moving the mouse pointer over the "button" the guest will see the button change. Clicking on the changed button will take the guest to that link. The above format was reached after in-house testing and AECB feedback both suggested that earlier layouts were likely to be too complicated and visually noisy for first time visitors.

Rationale

The Rationale section had to accomplish several goals. It needed to provide a general introduction to performance management, vis a vis Performance Indicators. It also needed to give face to the body of work that existed before the current project. As a consequence, material from The United States National Research Council's work on performance management and their Performance Indicators was included, as was the abstract from the Haber and Barriere Report. HCA did not wish to appear to be in any position that suggested we were passing judgement on the work of others and let the work of other authors speak for themselves.

Importantly, the previous work conducted by the AECB and its other partners repeatedly made point of the demand for clear standards, defined expectations and viable tools.

HCA's comments at the start of this section were as follows:

> The Atomic Energy Control Board of Canada has had an interest in Performance Indicators for some time. This project, in collaboration with HCA--Assessment Experts, is an extension of the AECB's work and interest over the past several years.
>
> We wish to give credit to those who have established the interest in Performance Indicators as well as our professional colleagues who have shared this route with us.

Some people have referred to Performance Indicators as a tool for performance-based management. As such it is a tool for managing with measurable results.

In a government setting, this implies that the expected results to be achieved through various programs, policies and services should be clearly articulated, that meaningful measures of success are selected and that accomplishments achieved are reported in a fair and credible manner.

In this Pilot, Performance Indicators are *the* tool by which:

- Raters have greater inter-rater reliability
- People can find out their scores **before** an inspection by doing it themselves
- People have access to their inspection scores and know how to improve those scores

In short, the ability to do better is placed in the hands of Licensees and Permit Holders and the AECB provides the tools to help with this progress.

Sign In

The next section available along the left frame (legend or navigation portion of the page) was called "Sign In." Originally created to allow the guest to save his or her sign in information, this functionality was removed as the AECB requested that persistent client-side cookies or other applet or scripting functions not be used within the prototype. This decision also impacted image roll-overs and other features designed to make the pages more interesting for visiting guests. Subsequently, this restriction was relaxed, and HCA modified this page to allow the guest to send his or her sign in information directly to HCA by e-mail. The form on the page has its contents e-mailed when the guest clicks on the "Send this form" button.

As it was, HCA did not expressly direct people to the Sign In page for the prototype. In a Web-based application, the signing in function would be performed automatically once the user has either visited the site before (using the same computer) or has entered his or her password. Signing in would also declare certain guest privileges, e.g., an Inspector could view any site but a Licensee could only view their own site.

Tutorial

The Tutorial button takes the guest to the tutorial page. Divided into six sections, this page was meant to help guests navigate and use the Web pages. The sections were:

- Getting Information in the PI Pilot
- Making Ratings in the PI Pilot
- Navigating in the PI Pilot Giving Feedback in the PI Pilot
- Supplemental Information in the PI Pilot
- Requirements for the PI Pilot

Descriptions

The Descriptions button takes the guest to select menu of documentation for various Performance Indicators. This information is meant to be included in a future Web-based application that includes AECB-approved descriptions of the finalized Performance Indicators. There are a number of instances where a function or task cannot be shown at this time (as a function of the prototype constraints) but HCA wished to show what could or *should* be present in the future. In this page, there is a reminder to the guest to review the other pieces of Performance Indicators information from Fergus Devereaux (in the Performance Indicators page.)

Performance Indicators

Clicking on this button takes the guest to a page that contains all of the Performance Indicators – arranged by use type name. Use type number originally organized this page, but it was discovered that practically all Licensees would find this too difficult.

In all, there were forty-four (44) different Performance Indicators links. In addition there were 73 different use types. In addition, there were a number of other elements on this page:

- Links for applicants for various AECB functions,
- The performance indictor checklists from Fergus Devereaux have a link in this page
- Preparatory links for in the start of the internal AECB staff Performance Indicators.
    - There were twenty-seven (27) groups of internal AECB staff, and each group has one or more business processes.

HCA discovered, however, that the AECB staff were not always aware of their relevant process numbers. This will be presented in greater detail in a subsequent section.

Having selected a Performance Indicator, (e.g., Portable gauges: 1 device, use type number 993) the guest would then have that page presented to them.

As each use type contained many of the Performance Indicators links, it was decided that each Performance Indicators page would show all Performance Indicators links. The links were the gray "click-able" boxes the opened a rating window above the current page in use. One of these gray clickable boxes was entitled "See Total Profile to Date." Clicking on this box would call a window that presented a real-time bar chart containing the previously entered ratings unique to that guest's computer. "Unique" because the previously entered values were stored as persistent client-side cookies.

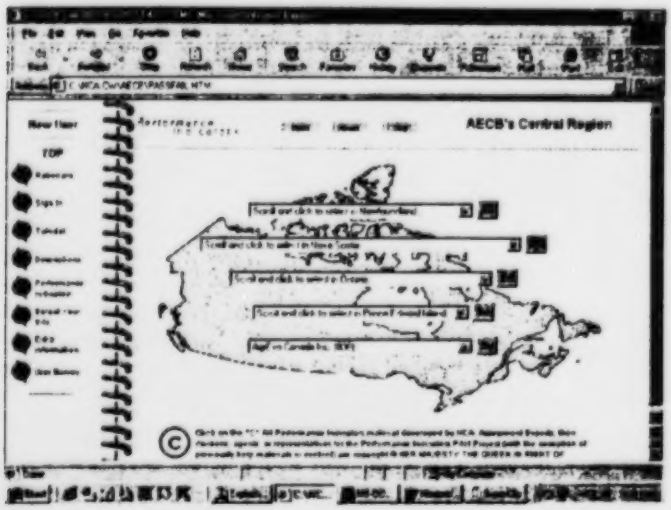
This allowed guests to rate themselves and actually use the prototype. HCA believed that it was important to show how self-rating could work as one of our promissory notes was that alleged rating could be reduced when Licensees could rate themselves, too.

Originally, HCA received a data file of some 2,379 Licensees. Subsequently, this number grew to 5,834 individual Licensee sites. To avoid a combinatorial explosion, and possibly repeating a number of page elements within each of the 5,834 pages, HCA decided to have each page link to one set of all performance indicator links.

This approach realized several advantages as HCA developed individual pages for ***all*** licensee sites in Canada. One primary advantage was that reasonable file sizes were maintained. Since each guest was requested to visit their own site, any subsequent ratings would yield values stored on the guest's computer. These values (and it is understood that not all performance indicator links would be completed) would then appear in the overall profile or bar chart for that guest. In the event that the guest had not made any prior ratings, this profile would be blank save for the names of the performance indicator links.

Select Your Site

This button took the guest to a map of Canada. The tool tip or mouse-over text asks the guest to click on their area on the map of Canada. This map was a client-side clickable image map. In other words, clicking on an area would take the guest to a page that corresponded to that area. If the guest clicked on Saskatchewan, for example, they would be shown a page that contained the sites within the AECB's Central region. The AECB has divided Canada into four regions: West, East, Central and Southern Ontario. The areas of the map of Canada correspond to the boundaries of these regions. The screen capture image below shows this.

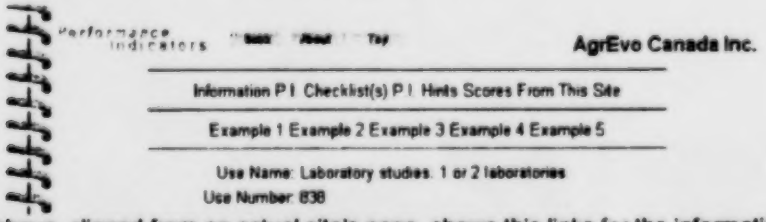


Alternately, the guest could scroll down the page containing the map of Canada and select his or her province or territory, and then their site within that province or territory. The guest does the same to select their site when they arrive in the regional division page. Scrolling through the list of sites, and clicking "Go" takes the guest to his or her site.

Various "telephone book" level information is displayed for each site, including: the use type name and number, licence number, a dummy value for the licence status and conditions, correspondence address, phone numbers, contact person, and the AECB office and zone.

In addition to this general information, each page also has areas for, or links to:

- Performance Indicator links
- Performance Indicators Hints
- Previous Scores
- Examples of rating feedback and charts
- Access to WordPerfect and Word versions of checklists.


Performance Indicators
AgrEvo Canada Inc.
Information PI Checklist(s) PI Hints Scores From This Site
Example 1 Example 2 Example 3 Example 4 Example 5
Use Name: Laboratory studies. 1 or 2 laboratories
Use Number: 838

The image above, clipped from an actual site's page, shows this links for the information within a page.

Supplemental Information

This link takes the guest to a fairly detailed page providing additional information about a number of additional features, page prototypes, and information related to the prototype web pages. Guests can view pages with data binding, sortable tables of information, proposals for security implementation, and the like.

As with the other prototype areas described above, a longer description is available as an Appendix to this report.

When discussing a collection of Web pages, a number of technical terms readily enter the conversation. In the passages below, we introduce some terms that are central to this discussion. These terms describe how Web pages are created (HTML,) how they are sent across the graphical layer of the Internet (HTTP) and how information from a guest can be saved on the guest's computer until the next visit (cookies.)

HTML, HTTP and Cookies

HTML

The word "HTML" is an acronym for "HyperText Markup Language" and refers to a standard for developing, reading and displaying information within a web page. Web pages may be thought of as static, dynamic or not, enhanced with applets, beans or scripts.

HTML is a "markup language" which means that Web pages can only be viewed using a specialized Internet terminal program called a web browser. As a much more complex subset of SGML (Standard Generalized Markup Language,) HTML offers a much more diverse viewing and interacting experience. HTML pages are sent through the Internet's graphical layer (the Web) via HTTP (HyperText Transfer Protocol.)

A web page is taken to mean a static (or dynamic HTML) page that makes no server-side demands of additional data, executable programs, CGI (common gateway interface) or PERL scripts that run on the server. All of the HTML pages designed by HCA make no server or client-side demands for data storage. A few data files (accessed by the dynamic HTML pages with data binding) read a static file from the server. Client-side cookies (small text files that store data) have been enabled, disabled and re-enabled during various times in the development of this implementation.

Dynamic HTML (or DHTML)

Dynamic HTML is one of a growing number of means of increasing the functionality of web pages. DHTML, XML and others are all growing in popularity and vying for user acceptance. Largely, they compete for this acceptance with other means of adding functionality to web pages.

Java

Java was originally proposed as an "compile once, run anywhere" application. It offered to seductive prospect of running on any web-aware device or browser. Java beans, for example, are precompiled Java applets (small applications), often presented as parts of larger suite-type environments. Initially very slow to load, Java has come to the fore again for its ability to maintain a language standard, platform compatibility, and markedly increased functionality. On-line database access, freedom from client-side constraints, and a sophisticated object-based development environment are pressing reasons for Java's popularity. Java applets, beans, and files with the .JAR extension may all be thought as Java "programs" for the Web.

HTTP

HTTP is (loosely) a means of sending web pages. A web page is transferred across the Internet's graphical layer (the Web) by means of a special transfer protocol: the HyperText Transfer Protocol, or HTTP. If the reader recalls, when one types a web address, it begins with "http://" to signify the transfer protocol.

A unique feature of the HTTP is that is was designed as a "stateless" protocol. Translation: The server does not dedicate a session to each client connection. The situation is something akin to having several conversations – all at once. You can either, dedicate yourself to each single conversation (and make everyone else wait,) or you can just share the time you need with each person and "connect" with the others.

From the perspective of a computer acting as the server, the server can dedicate itself to each user (very inefficient) or it can allow each user to connect, get what it needs, and leave. This is

why you see the messages about "Contacting server..." and "downloading file..." when you click on a link on a web page.

What this means to the conversation analogy is that you can conduct "snippets" of a conversation and not cause others to queue up waiting for you.

This stateless protocol is convenient, fast and allows even modest servers to handle a lot of traffic. Yet, there are many times when there is a strong argument for saving "state" information or user information or preferences.

Cookies
The small text files that reside on a computer during Web sessions are called "cookies." They offer the ability to store information about users, their preferences, earlier responses, etc., between page loads and page visits. This ability allows the Performance Indicators prototype pages to retain information and ratings about one's own site even after they visit the prototype web pages. Cookies overcome a primary limitation of a stateless protocol.

A "persistent, client-side cookie" is a piece of information that resides on the user's (client) computer until such times as the user deletes that information. *Persistent* refers to the fact that the cookie stays on the users computer until the user deletes his or her temporary Internet files. *Client-side* means that the information resides on the user's computer (the *client* "side") and not on the server.

Persistent, client-side cookies were a ready solution that allowed web page guests to conduct their own ratings, and revisit those ratings at another time.

Ok, so what does the above mean?
While the above technical reasons are very sound and positive (to technical people) one of the best reasons to develop web applications has not yet been mentioned.

The Web finally offers a real chance for organizations to see meaningful gains from their Information Technology (IT) investments.

In examples too numerous to mention, organizations have failed to realize demonstrable utility from their IT investments. Employees get newer, faster and better computers. Networks get larger and more expensive. Customers have access to more "bells and whistles." Newer, faster, "better" has rarely resulted in demonstrable savings or net utility gains. In fact, the overall return on IT investment throughout North America has largely been negative.

HCA's approach, on the other hand, has been to develop a prototype that can be used as a viable display and presentation tool. Web page guests can review documentation, rate themselves, revisit those ratings, and the like. The functionality is there to preview the intentions for future Performance Indicators project work.

AECB Constraints

What Not To Send:
The constraints posed by the AECB pertaining to computer programs and the AECB staff computers were reasonable but precluded the delivery of executable programs by HCA. HCA was specifically requested to avoid sending executable code (i.e., programs) to employee or Licensee computers. Compiled programs, programs making use of external data (that might be compromised,) ActiveX components, Java applets and the like were to be avoided. This introduced some logical inconsistencies. For example, Microsoft's Internet Explorer has some built-in ActiveX features – so "having" them was largely a moot point.

HCA understood, however, that the Board's intention was to avoid compromising existing systems and set-ups. To deliver the "look and feel" of a web-based program, HCA chose to develop a large-scale integrated web site comprised of static (no additional server demand) HTML pages.

To provide the additional functionality (and suggest development paths for the future) HCA included numerous JavaScript scripts in the web pages. These scripts are external pieces of JavaScript code that are used by HTML pages. One script can service a large number of pages. In fact, our preparatory work in the development of unique password protection was based on this.

Browser Selection
Microsoft's Internet Explorer was chosen as the client platform for the JavaScript and browser versions deemed necessary to view the Performance Indicators web pages.

Microsoft Internet Explorer version 4 was chosen as it is a member of an earlier version of the popular Windows platform and is the default browser in many corporate environments.

The selection of browser posed a few difficulties however, since a number of the AECB staff computers had various versions of various browsers. In the Ottawa office, for example, there were at least three different versions of Microsoft Internet Explorer. Earlier versions would not correctly display the JavaScript functions and would not allow certain HTML features. It is important to note that Microsoft Internet Explorer version 4 was approximately two years old at this time. AECB requested that HCA send staff to Ottawa to install a version of the prototype identical to the one on HCA's site. This task was completed with the computers available within the AECB's Ottawa offices, resulting in a local area network from which staff could view and interact with the prototype pages.

Why an HTML Design for the Prototype?
HCA understands that not all people are familiar with HTML. We also understand that the technical descriptions offered above might sound like "computer-ese" or just plain awkward to follow. If that's the case, the simpler version is that HTML is how web pages are built.

Moreover, web pages can be viewed by a number of browsers. There is now a rapidly emerging group of Internet-aware computing devices and consumer computing devices, supplementing the number of computers that browse the Web. AECB clients may not be able to view the Performance Indicators prototype with their toaster *now*, but they can with their desktop computers, notebooks, cell phones and hand-held computing devices.

In short, access to web (HTML) pages is largely a non-issue. Estimates place the growth of the Web at doubling between every three to five months. This growth of the Web means that a new educational, communications and training medium has arrived.

Who has Access to the Web These Days?
The rates of growth for the World Wide Web noted above are conservative estimates. Nearly everyone in North America has web access in one form or another. Sales of Internet-ready computers have exceeded those of colour television sets at Christmas for the past few years. If people do not have access from their workplaces or homes, there is available access from public libraries, Internet cafes, and other locations. We do not suggest that Licensees stroll to their public library to see their ratings, only that Internet use is growing for both Web browsing and e-mail.

Given the tremendous and unsurpassed growth of the Internet, HCA began with the assumption that most current (and nearly all prospective) AECB clients would have some form of access to the Web. While it may be that some AECB clients do not have web or e-mail access at this, more will, later. As a case in point, the Canadian Federation of Independent Business has stated that

current rates of Internet access and corporate e-mail were in excess of two-thirds. This is an empirical question and the final listing of survey responses will help in this delineation. However, the direction of use is clear. More people will have Internet access.

Access to All Previous Ratings
Ideally, HCA would have preferred to offer all radioisotope users access to all of their previous ratings. This would have required that the AECB make available all previous ratings. The Board would have had to copy or transmit all previous ratings to HCA, who would in turn translate these to the relevant Web pages.

While clearly not feasible during the early portions of this prototype work, a server-side database of ratings would accommodate this task. Rather, HCA asked to AECB to provide a list of radioisotope users, complete with some basic information. The first version received by HCA included rudimentary information for some 2,379 radioisotope users.

Initially, HCA created a page for each of the 2,379 users. The AECB then delivered a spreadsheet file to HCA that contained 5,834 separate listings.

At this point, there are more than 7,000 files, 60 directories and 130 megabytes of information in the Performance Indicators prototype.

HCA has already drafted a password-lockout utility and will be migrating to a secure server in late September 1999, to augment the web serving currently contracted to an ISP (Internet Service Provider) where an HCA server resides in their server pool.

Ability to Offer Feedback
Throughout this large range of files and files types, HCA attempted to keep feedback from users an easy task. Most instances only asked user to click on a button on the web page. When pressed, the button would send one of a number of types of message. The button-click was one of several web-based communications venues available to visitors to the prototype site.

- A predetermined message
- The contents of a form (i.e., select a option by choosing an item in a pull-down list, clicking a radio-type button, or checking a box
- The contents of a text input area (for longer types comments

Visitors to the prototype could also offer feedback by faxing, phoning or e-mailing HCA. At all points during this project, HCA maintained its commitment to interacting with participants and keeping as many communications channels open as possible.

Where Do Radioisotope Users Come Out Ahead?

As has been suggested above, tremendous effort went into the creation of a set of web pages to serve as a realistic preview of a possible future Performance Indicators application. Every single licensed radioisotope user in Canada was presented on the web. Many interesting and work-saving features were available for people to see.

Yet, a key question remains: "Where do radioisotope users come out ahead?" Anyone can make a web page; young children do it every day.

The areas wherein the AECB's clients clearly gain from this exercise can be listed below. They can now:

- See the AECB's commitment to Performance Indicators and to sharing the evaluative and rating guidelines *before they are themselves rated*,
- See the AECB's commitment when they can provide customer service ratings of inspectors and LAO's,

- Practice rating their own sites,
- Use the prototype to communicate expected standards to their staff, co-workers and others in their organizations,
- Review the sets of hints and tips for continuous improvement,
- Offer suggestions for how they would to see their site's progress tracked or presented.

This list can continue, but the largest feature is that the AECB's commitment to change is clearly evidenced.

Section Two Summary

- This second section presented information about the Performance Indicators prototype web pages.
- A very large collection of linked web pages is now in pace. These pages are easy to access.
- A "How To" section provided instructions on navigating the web pages. Readers should be able to find any site in Canada on the provided CD.
- Brief discussion of web issues was provided (with more information available as an Appendix.)
- This section closed with a brief listing of the favourable outcomes for licensees. This includes, but is not limited to: easier access to rating criteria, the ability to self-monitor, establishment of groundwork for user-owned responsibilities for continuous improvement, mechanism to abolish rater bias perceptions, and the like. The development of the prototype was a "proof of concept" exercise that was successfully completed.

Section Three: The User Survey

The user survey was faxed to every radioisotope user in Canada. As well, e-mail attachment and web-based forms versions of the user survey were also available. The survey may be viewed on the accompanying CD (in the main left navigation frame) or on the Web at the following URL: http://www.hcaassessmentexperts.com/aecb/hsurvey.htm.

In the survey cover letter, HCA stated that: "Our intention is to show how a web-based tool can:

- Reduce biases and errors in ratings,
- Improve ratings between raters (i.e., you and your Inspector)
- Make clear what the rating expectations are
- Ensure that everyone is working from the same set of rating rules
- Foster continuous improvement in radioisotope safety, and
- Help you manage your radioisotope tasks better, in less time."

The user survey was designed to:

- Gather relevant information about the AECB clients. During the earlier phases of the current project, HCA discovered that some of the ILS data needed updating and e-mail addresses needed to be included. HCA agreed to help update the AECB's client files by providing this information.
- Ask some general questions about Performance Indicators,
- How to find their site in the web pages,
- Ask for their feedback if they had been to the Performance Indicators site.
- Ask about their "professional preferences" (independent of visiting the web pages) regarding Performance Indicators feedback.

The user survey was driven by two elements.

- One was the logical need to collect feedback about the usefulness of the site, as viewed by actual Licensees and users. This was to be one of HCA's outcomes. HCA intended to perform a random sample but this was changed so as to contact each Licensee by fax.
- The second driving element was the request by the AECB to solicit every user and secure up-to-date information, including the fax numbers and e-mail addresses that were missing from the ILS database. In an amendment to the project, the AECB provided roughly two additional months funding for this expansion to an earlier task.

HCA conducted a first round of faxing comprised of a random sampling of about one-quarter of the Licensees. This was expanded to all Licensees. The intention was to determine a turn-around time for the larger faxing task and make an estimate of the response rate so as to determine the window of time needed to gather feedback from all parties. The first phase of faxing went well, but responses were slow in returning.

In the second round of faxing, HCA faxed the *complete Licensee list*. The returns were also favourable, but responses were also slow.

Respondents gave apologies and cited summer schedules, busy timetables, and other causes for their tardy delays. These explanations might describe *why* responses were as slow as they have been. Certainly this was evidenced in an earlier project when some of the "best" AECB sites were designated recipients. The "best" sites" were no more forthcoming that the sites with lesser grades. This is am important point. Surveys often get favourable answers from "better" respondents. In our experience with the AECB Licensees, this bias was not apparent.

HCA takes its professional responsibilities seriously.

As a result of the slow rate of returns, HCA offered to waive its last invoice (or part thereof) or to submit the last invoice only after a critical mass of responses have been met to satisfy the AECB's need to update its files.

The compromise that was reached was that HCA was asked to submit all invoices as per the established contract terms, and HCA volunteered to continue contacting Licensees for their information until November 1999.

While HCA could not anticipate the degree to which responses would be tardy, we did assume a business-like attitude on the part of Licensees regarding the return of correspondence. We present the summary responses below. HCA is submitting the data file of respondent names, e-mail addresses, correspondence information and the like under separate cover.

Responses: "In General" Section

- Do you have access at work to Internet Web pages? (82%)
- Which browser do you use at work? (Majority: Internet Explorer, version 4)
- Which browser do you use at home? (Majority: None, those that had browsers at home, though, typically had version 4 or higher of either the Microsoft or Netscape products.)
- Do you like the idea of reducing rater error(s) by making all Inspectors use the same standard for their evaluations? (96% said yes.)
- Do you want to be able click a button to print or download a paper copy of each performance Indicator (per each AECB Use Type?) (90% said yes.)
- Would you rather use a paper version over the web version? (40% said yes.)
- Would you want to see ONLY an overall rating from the AECB Inspectors? (27% said yes.)
- Would you want to see an overall rating AND specific breakdown ratings from all sites within your location from the AECB Inspectors? (80% said yes.)
- Do you think the Performance Indicators tool will be easy to use? (88% said yes.)

Note: These responses were based on the data from all respondents.

Responses: For those who have been the Web page

- Do you think the Performance Indicators tool will be easy to use? (93% said yes.)
- Was the Performance Indicators Prototype web page easy to use? (93% said yes.)
- Was it easy to click on map of Canada to find a site to rate? (92% said yes.)
- Would it be easier for you to enter your licence number, use type and site address to get to your site? (35% said yes.)
- Do you want to be able click a button to print or download a paper copy of each Performance Indicator (per Use Type?) (98% said yes.)
- Would you rather use a paper version over the web version? (20% said yes.)
- Did you see your hypothetical site ratings and bar charts? (55% said yes.)
- Do you want to provide an overall rating based on your inspections -- as opposed to rating all possible sites within the general inspection site? (64% said yes.)
- Comment field 1: (What other information would **you like to see** presented about your site?) Most people raised comments about the desire to see more information about their site, with requests for either more security or information about possible future security measures. They liked the idea of seeing more information, but not the idea that other people might see that information. (23% of all respondents made a comment.)
- Comment field 2: (What other information would **you NOT like to see** presented about your site?) Most people replied here with comments about the wrong data that appeared on their fax cover pages. Company and personnel name changes, companies that closed. One respondent found "wipe test" spelled "wipe tesst." One respondent wrote on the return cover page: "Please note: My name has changed as of 1 year ago. I find it

offensive that organizations consistently fail to acknowledge the change. Thank you, *name withheld by HCA*." (15% of all respondents made a comment.)

Note: These responses were based on the data from those respondents who had been to the Performance Indicators Pilot site.

Responses: Some questions about your professional preferences...

- Do you want to be provided with an overall rating based on your AECB's Inspector's ratings -- as opposed to rating all possible sites within the general inspection site? (88% said yes.)
- Would you like to be able to compare your individual sites within your location to the overall rating? (84% said yes.)
- Will you use Performance Indicators to show Licensees and Permit Holders where their ratings came from? (71% said yes.)
- Do you think the use of Performance Indicators will reduce the instances of (claimed) rater bias? (72% said yes.)
- Do you think the Inspectors' comments will be helpful to you? (When they provide that feedback through supplemental comments and feedback forms.) (98% said yes.)
- Do you think it's a good idea for you to have a copy of the **same** rating criteria used by Inspectors? (98% said yes.)
- Do you like the idea of being able to "pre-rate" yourself so that you know where the evaluation number came from? (90% said yes.)
- Do you think that Performance Indicators would help you to improve your ratings? (89% said yes.)
- Would you like to be on our e-mail mailing list to receive news about the progress of the Performance Indicators Prototype? (79% said yes, although this number is actually slightly higher as a number of respondents asked for "snail mail" correspondence.)

Note: These responses were based on the data from all respondents. Therefore, the strongly favourable replies in the above section *include* those who have not been to the web pages for the Performance Indicators pilot. These replies are based on the principle issues central to Performance Indicators and are separate from simply liking web sites.

A few observations are worth noting at this point. Of the 2,379 original members in the AECB ILS database information, fully 433 could not be reached at all. All sites were faxed *at least once*. Failure to successfully send a fax resulted in a voice call to that user. Failure to get through by voice, landed the fax cover page into the "Could Not Reach" folder. In this reduced sample, of 1,946, HCA received 427 completed and usable replies by mid-August. This number yielded a mid-August return rate of 22%, with a number replies arriving daily.

The return rate of 22%, however, is still respectable for a survey conducted during the summer vacation period.

Given the sample size, the overwhelmingly favourable results from the data at hand might be interpreted in either of two ways.

First Interpretation: Preaching To The Converted
Only the "hardcore wired" (i.e., serious Internet users and computer advocates) replied to the faxed survey and were, therefore, the type of people who would like such an offering anyway.

Counterpoint:
If it is to be argued that only one-quarter of the licensees are now "Web-Aware," it is also argued that this number is a conservative estimate and that whatever the true size, this true size is growing at an unprecedented rate. Therefore, size doesn't matter this time.

Counterpoint:
Not all licensees had Web access from work. Moreover, not all licensees visited the Web page. The ratings from the people who responded to the faxed survey and who *did not see the web pages* were still very favourable.

Section Three Summary

- This third section provided the overview of the results from the survey sent to all radioisotope users in Canada.
- The results were overwhelmingly favourable. Importantly, those who liked the idea of Performance Indicators liked it *better* after visiting the web pages. Consider:
  - Do you think the Performance Indicators tool will be easy to use? (93% said yes.)
  - Was the Performance Indicators Prototype web page easy to use? (93% said yes.)
  - Was it easy to click on map of Canada to find a site to rate? (92% said yes.)
  - Would it be easier for you to enter your licence number, use type and site address to get to your site? (35% said yes.)
  - Do you want to be able click a button to print or download a paper copy of each Performance Indicator (per Use Type?) (98% said yes.)
  - Would you rather use a paper version over the web version? (20% said yes.)
- While the return rate was not as high as we might have liked, completed surveys are still arriving at HCA. Moreover, HCA has extended its commitment to a longer follow-up with the radioisotope population. No new data has suggested a change in the results.
- The discussion of the return rate concluded that the sample at hand was robust and representative.
- Respondents are now actively looking forward to a fully implemented web application to help them with their ratings and their continuous improvement efforts.
- The AECB is now seen as a *de facto* provider of assistance because they placed the prototype at the disposal of their licensee population.

Section Four: The "Data" and the "Application" for Performance Indicators

A truism of the computer world is that what you put in is what you get out. In the case of a data intensive application, the integrity of both the data *and* the application drive success. In the current project, the *data* issues pertain to:

1) The data from the AECB
2) The data collected by HCA from radioisotope users
3) The data collected by HCA from internal AECB staff.

Issues pertaining to the *application* are largely concerned with ease of use, validity and the ability to foster better assessments and ratings.

Having said that, other salient "data" issues also require examination, including such topics as security, data farming, levels of access, and the like. These will be address further, below.

Data from the AECB

The data supplied to HCA from the AECB was from the Integrated Licensing System (ILS.) Presented in Excel spreadsheet format, the first delivery contained 2,379 ("sample One") listings while the second delivery contained a more detailed version on the same information, yielding 5,834 ("Sample Two") listings.

The data was used for two reasons:

1) To develop site-specific web pages. This afforded *every* Web page guest in Canada the opportunity to:
   - View a correctly titled site (i.e., one that was "theirs")
   - See rudimentary information about their site
   - Confirm the accuracy of the data, as presented in the web site
   - Establish a comfort level with having ratings attached to site access. In this case, the guest could see *hypothetical ratings* (based on random numbers.)
   - Create a base-level familiarity with having access to AECB Inspector ratings

2) To create a unique fax cover page for every member of the Sample One group.
   - These cover pages were attached with a five-page survey and faxed to every Sample One group member at least once.
   - Each page was used as the "audit trail" for entering corrected information, the contact log, and the like.

Cycle of Data

In the Sample One data, an archival copy of the original AECB file was created as a back up. Then a first-pass review of the data was conducted upon receipt of the data file. This review was intended to verify that the data had been normalized or standardized in some manner. The next step was to repair the address and related information that had been confounded in the migration from the ILS data format to a spreadsheet format. Next, the data was extracted from the database format to a plain text file – so as to be machine readable to HCA in-house applications as well as for the mail-merge to generate the 2,379 fax cover pages. Each HCA in-house application also contained various data testing and verification routines.

Backups were conduced daily, and at the end of each workweek (or at the end of an FTP session to upload Web pages to the HCA server located in an ISP's server farm.)

FTP sessions to update the HCA web pages were performed frequently. At times, as many as several uploads were completed per day. Typically, however, the entire web site was refreshed once a week with new files, updates, and pages upgraded per AECB or Radioisotope user requests. The web pages were changed in this manner so as to demonstrate to the AECB client population that the Board and its contractor were responding to suggestions and requests in a timely manner.

Security

"Pretty Good Security," like "Pretty Good Encryption" suggests that a reasonable level of security (or encryption) can be attained. It also recognizes the probabilistic not absolute sense that security (or encryption) can be sustained. The reason for the "Pretty Good" title is that having absolute security is a near-impossibility. Moreover, a balance must be struck between the security (how hard it is to get to where you're going) and overall convenience and ease-of-use issues.

In many instances, including the Performance Indicators project, security is often interchangeable with privacy. One Licensee's rating history is private and needs to remain so – other Licensees should not have access to material that is not their own. Moreover, a privacy or security policy is important. The Georgetown Internet Privacy Policy Study (which can be located on the Web at http://www.neptune.gsb.georgetown.edu/culnanm/gippshom.htm) indicated that 94 of the top 100 Web sites have enforceable privacy policies, reaching 98.8 percent of all consumer Web traffic.

The Performance Indicators pilot pages contained only rudimentary information about Licensees, as at one stage, all Web guests could see all Licensee pages. To protect privacy, HCA only included the "phone book" information provided by the AECB and used hypothetical (i.e., random) data for graphical displays of empirical information or ratings.

While visitors to the Web pages can enter their own ratings at this time, there is a constraint on the number of rating categories they can complete. There is a twenty-cookie limit on most browsers. Since cookies (small text files) were used to store temporary information on the visitors' computers, they could only store their ratings scores for twenty of the thirty-eight possible rating categories. The overall profile will show all thirty-eight rating categories or elements, however, but it generates a random value for each element *as the page loads*. In this manner, all users will still be able to see a complete site profile that retains confidentiality, but not at the expense of reducing the profile they are viewing.

The current release of the Performance Indicators Pilot Web pages includes a password-based security system. Guests to the Web pages had to include a subset of their Licence Number in order to access their page. This version is contained in the CD that accompanies this final report.

No one will argue about the need for security. Clearly there is a manifest need. For the purposes of this report, we will address two broad security mechanisms:

1) User-supplied "keys" to entry, such as encrypted keys, passwords, and the like, and

2) Machine-readable agreements wherein a service sends a machine-readable proposal detailing the identity and security practices to the client. This proposal applies to one or more URL's and is automatically parsed by a user agent, such as a Web browser. If the user has already agreed to the proposal, the user does not have to review the privacy policy at every visit.

For the purposes of this report, and its general audience, HCA will not specifically discuss SSL (Secure Socket Layer) or TLS (Transport Layer Security) security protocols or scalable security at this time. Also, while HCA has strong interest in RMI (Remote Method Invocation) for Java applications, discussion of SSL for JAVA RMI will be left out, as well. We have, however, included a more technical discussion as an Appendix to this report.)

Keys and Passwords
A key or password is a common enough privacy tool. We have keys for our homes, and passwords for our bankcards. A problem with keys and passwords is that they are simple tools and can be overcome.

Ideally, keys and passwords will let only one person have unique ownership or access to information. Your key should let you view your information. Your key should also prevent anyone else from having access to that information. Your key should be unique, should prevent loss of privacy, information, or damage to your privacy or information. Groups such as the Treasury Board of Canada's Public Key Infrastructure (PKI) Task Force have attempted to derive standards for encrypting keys and cross-certification arrangements.

The PKI Task Force seeks to find solutions and recommended practices so that your information (e-mail, access to a web page, credit card transaction, etc.) is not stolen or compromised on its way *to or from you*.

Before encrypting and sending information (such as a password for a web page) it's important to ensure that the public key being used for that encryption does indeed belong to the intended party. In the same way we trust a courier to deliver a package to the intended recipient, the recipient also needs to confirm that the package really is from us. A certificate can be used to make this assurance. A certificate authority checks the sender (owner of the public key) and then digitally "signs" a certificate verifying that the public key attached to the certificate belongs to you ("Yes, it's really me who sent you that courier package.")

Digital certificates help make electronic transactions more secure as they allow all participants in "the courier cycle" to readily verify the other parties.

Data Farming and Maintenance
The future Performance Indicators web-based application should likely be able to perform its own data farming. This refers to the application's ability to ask users about certain pieces of information and ensure that the most recent (and valid) data is retained. As well, the application should maintain both its own proprietary database(s) as well as ensure that data shared with, or culled from, other applications or databases are also valid.

The truism "change happens" is prominent in any discussion about people, their work or their information. While keeping a record of past ratings and comments is relatively easy, maintaining information about site contacts, who works where, which companies are still in business is not.

HCA's own experience with the data from ILS supports the above observation ten-fold. The data we received from the AECB was likely much less than two years old.

Levels of Access
The sign in information provided from the user should be used to determine the level of access to information within the future application. In the current application, people must provide a five digit element from their licence number as the password to their page. In the future, the application itself should remember who has what privilege. This information can be passed from machine to machine without user intervention (no one really likes filling in too many forms) but some personal confirmation of identity will likely be required.

The next section describes the inclusion of AECB staff in the Performance Indicators prototype.

The AECB is apparently already in discussion with agencies pertaining to security issues. Hca has provided copious information and a CD copy of the entire Performance Indicators web site to one group. Other groups, such as the Treasury Board of Canada's Public Key Infrastructure (PKI) Task Force will likely consult about, or set the standards for encrypting keys and cross-

certification arrangements. HCA will be pleased to assist in this regard. In our considerations of how such a secure Web application would work, a secure server with positive user identification would be *at least* the starting point for security considerations.

Some "Application" Considerations: The Use of Standardized Scores
For any future implementation of Performance Indicators to be considered a valid application, some other considerations should be aired at this point.

There needs to be a core set of ratings that can be applied across all radioisotope users. HCA developed the Safety Culture scale for two reasons. The first was the difficulty in securing a job description for the position of RSO. The second, and psychometric reason, was to provide a measure that could span different users. That is, not all sites would be rated with, Veterinary Nuclear Medicine, for example, but Safety Culture would be present.

There also needs to be a scaling issue resolved. The use of standard scores would alleviate a great deal of confusion over score reporting and interpretation. Standard scores can not be set at this time, or during the current project, but could be determined once data has started to flow from the end users.

Standard scores are a linear transformation of raw data. They are centered about a mean a given a specific unit variance. They also help in making meaningful comparisons.

For example, a consolidated licence site *could* make rankings based on raw data (i.e., simply rank permit holders by their overall raw score.) Yet these raw data rankings would not tell a complete (or perhaps ever accurate) story. Note that rankings alone are not meaningful *enough* (on their own) to be used in employee selection decisions, as an example. Olympic athletes are "ranked" when they are given placements of first, second and third, or gold, silver and bronze, respectively.

Yet this raw score ranking would convey no information at all about the relative differences between the ranks. We do not know the size of the difference between the performance or score that earned a gold medal versus a silver medal based on the medal ranking alone.

To turn the Olympic medal example back to the consolidated licence, the person looking at the information would not know how much "better" or "worse" compared sites were.

Psychologists have used standard (or standardized) scores for over a century. Unfortunately, the candidate for the most popular standard score is the Intelligence Quotient or IQ. Psychologists have never advocated the use of a single score to represent a profile of scores or abilities, but the IQ score has been integrated into common parlance. An IQ score has a mean of 100 and a standard deviation of 15. Roughly two-thirds of the population would have a score between 85 and 115 (plus or minus one standard deviation from the mean.)

The preferred solution when using a standard score is to provide a number that makes sense, but that does not have a negative connotative meaning. Clearly, a low IQ score conveys certain information. A score whose average is 50 and standard deviation is 10, however, is another matter. These scores are called "T-Scores." A resultant standard score of 40 would mean that the participant is at the very bottom of the two-thirds portion of the population at hand. A resultant standard score of 60 would mean that the participant is at the very top of the two-thirds portion of the population at hand. Similarly, 70 would mean that the participant was higher than 95% of the population, and a score of 80 would be higher than 99% of the population.

If the AECB decided to set a higher average number, this too can be accommodated. For example, if a "pass" used to mean 50, it might be that the "new pass" would be 75. A new standardized score could be generated with a mean of 75 and standard deviation of 5.

The use of such a standard score would permit across-time, across-user and within-user comparisons – even when different types of raw scores, numbers of items per scale and the like are taken into account. The Safety Culture scale might have more items than a scale measuring compliance to Inspectors' notes. With a standard score, the two can be compared.

Lastly, a small technical aside pertaining to a "levels of measurement" issue. There are four levels of measurement:

Nominal or Categorical. Simply putting names to things, actions, people, places, different dispositions creates a nominal variable. This is the same as merely describing things by placing them into different categories. For these reasons, a nominal (or categorical) variable only conveys the name of the variable, with no other information. A nominal variable is convenient for making people aware of the differences between apples and oranges, but not for saying that an apple is so many units larger or smaller than an orange. Nominal variables are used to classify or describe -- the simplest level of description.

Ordinal. When variables have been put into some kind of order (shortest to tallest, least to most expensive, largest to smallest) the researcher has created an ordinal variable. Nominal variables whose values have been ordered are known as ordinal variables. For example, the nominal variables "apples" and "oranges" become one ordinal variable when the order is based on the diameter of the fruit. An ordinal variable is the next highest level of measurement. Nominal and ordinal variables should only be used for description.

Interval. The most important feature of an interval variable (i.e., interval level of measurement) is the presence of equal-size intervals, such as can be accomplished with a standard score. These equal-size intervals permit comparisons that let people describe how much of the variable is present, as well as the relative amount of that variable. The only condition is that the intervals be equally spaced. This lets the researcher know that a rating of seven on a seven-point scale is higher than a rating of six, and a lot higher than a rating of one. Note that the researcher cannot say that a rating of six is twice as important or twice as large than a rating of three. The numbers are only abstract labels that happen to accompany the equal-size intervals. Interval variables are good for collecting relative ratings.

Ratio A ratio variable (or ratio level of measurement) is the variable that conveys the most information. It has the equal-size intervals of the previous variable type, but a ratio variable has one additional feature. The ratio variable has a null-value or a zero point. The presence of a zero point might not appear to give the term "ratio variable" a very logical name. The zero permits ratios. Without reference to an absolute point, comparisons (or ratios) between the intervals are impossible. With a ratio scale the researcher can say that a six is twice as large as a three. A site cannot earn a negative score, but it can earn a zero score. In the current context, a score of zero would mean that none of the Performance Indicator elements have been rated as above a failure.

All variable types (levels of measurement) can be used for purposes of description. Not all can be used to make any inferences about relationships, changes in time, growth, or other comparisons. Only interval and ration variable types permit this. This is what standardized scores will provide for the AECB.

Section Four Summary

- This fourth section described some of the features and concerns that are central to both the Performance Indicators prototype and any future implementation.
- The Performance Indicators prototype web pages are contained in the CD that accompanies this report. The CD is self-loading once inserted in the computer.
- HCA will be pleased to discuss other specific issues and recommendations for any future implementation of a Performance Indicators application.

- The AECB is apparently already in discussion with agencies pertaining to security issues. HCA will be pleased to paticipate in any such discussion if invited to do so.
- The ACEB needs to incorporate some implementation of standardized scores into their future Performance Indicators efforts. Others, any type of comparisons will be difficult, at best.

Section Five: The Logic for Including AECB Staff and Service Providers

The AECB has a responsibility to show that all of the elements in the radioisotope evaluation process are fair and equitable. People understand that the Licensee evaluations must be fair and equitable, but this vision does not always extend to the other elements of the Licensee evaluations or Licence management tasks.

HCA would suggest that the only means by which the AECB could have demonstrable fairness would be to include all people within its auspices who have a part to play in the management of licensees and radioisotope users.

Early in the current project, HCA recognized the need to include AECB staff in the evaluation process. This need was manifested from several sources. The AECB had to show that they were applying Performance Indicators to *both sides* of the compliance topic and to do so without assuming poor performance on either side. Performance Indicators had to remain a helping tool and not a device for blame or castigation.

Separate from performance appraisals that used for compensation or career decisions, Performance Indicators for AECB staff and service providers should be positioned as a direct extension of the work with licensees and permit holders and then be brought into play to accomplish the following:

- Have demonstrable proof that the AECB is taking the mandate of Performance Indicators seriously
- Make clear organizational expectations
- Share these expectations in a *a priori* sense so that performance standards are communicated before evaluations take place
- Reduce the ambiguity that arises from subjective self-reporting of performance
- Narrow the gap between the expected levels of performance and actual performance
- Demonstrate to radioisotope users, Licensees and Permit Holders that all elements of the radioisotope process are included,

In meetings with the AECB staff, several incidents made it appear as if no little dissatisfaction was present within staff. Clearly, the AECB is an organization undergoing change and change can be stressful. To mitigate change-related stress, it was decided that Performance Indicators for AECB staff remain a strict aspect of the larger Performance Indicators project within MRD. The possibility that staff Performance Indicators would be viewed negatively was quite high – unless it was made very clear that this work was the logical continuation of earlier tasks and not a tool for compensation, career decisions, access to privilege and the like at this time.

In short, by including all links within the radioisotope process, the Board can unequivocally demonstrate fairness and the seriousness it places on Performance Indicators. This step will forestall future issues relating to radioisotope users' perceptions about only addressing performance issues on "their" side.

Links Between Performance Indicators and Continuous Improvement
The single largest area for success within the Performance Indicators venue is in the fostering of continuous improvement. HCA has spoken at length internationally on this topic. The term "Kaizen" refers to the spirit of continuous improvement.

The Atomic Energy Control Board is already aware that Performance Indicators serve to make clear organizational expectations. They would also appear to understand the four elements listed above for the successful implementation of any performance feedback, goal setting, or performance evaluation application.

By necessity, the desired continuous improvement facilitated by Performance Indicators will lead to some changes and shifts of style within the AECB. The phrase "shifts of "style" was used to convey the sense that how some tasks are completed will likely change. We will list some of the changes and shifts below.

Inspectors may not be immediately comfortable with having their rating guidelines released to licensees and permit holders prior to inspections. A number have already expressed this concern.

While it is true that some inspectors do not immediately favour the release of rating elements to their clients, many more inspectors have expressed welcome at this idea. Experiences described to HCA by inspectors across Canada confirms the expectation that Performance Indicators will be largely viewed as a work saver and not a work multiplier.

Radioisotope users, permit holders, RSO's and others will have to assume greater responsibility for their ratings and performance. This is likely to meet with resistance among those members who already resist change.

This is not groundbreaking news. People who resist change will resist many changes.

People will invent "excuses" for poor performance and attempt to limit their personal (professional) responsibilities and liabilities by shifting them to others in their organizations.

Again this is not new. Unfortunately, when workplace performance has been managed for long periods of time under a largely "do your best" environment, several things occur. One is that people's performance tends to slip to the lowest common denominator (e.g., "I won't get fired if I only do *this much*.") Another is that successful performance is not valued as greatly as maintaining the status quo. Yet another aspect is the phenomenon of protecting one's organizational "turf" by shifting blame for poor performance elsewhere or by rejecting the change that allocates responsibilities to the individual in question. Typical self-report statements are "I'm too bust to do that," "You've never asked to assume this responsibility before," and the like.

The reality is that radioisotope users, permit holders, RSO's and others have almost always had the responsibilities in questions. The members of this group have also been charged (vis a vis their positions in their relevant organizations) with the accountability that comes with those positions.

The AECB has the somewhat unfortunate task of reminding these few members of its client population about their accountability.

Bleak descriptions about the behavioural patterns of low achieving people aside, the AECB has an exceptional opportunity before it.

> **First**, note that most people are in favour of clearer rules.
> **Second**, higher ratings have always (to some degree or another) meant favourable outcomes.
> **Third**, people must have the ability to monitor their own progress and incremental successes.
> **Fourth**, lower ratings must have consequences that motivate people to perform better before the next official rating.

By its very nature, Performance Indicators do three of the above. The last point is one that must be addressed systematically and with firm policy by the AECB. HCA is already on record as a "three strikes then out" policy regarding low levels of performance or compliance.

With the fourth point above addressed successfully, the linkages between Performance Indicators and continuous improvement are robust.

The Survey to AECB Staff

HCA prepared a service-based survey for the AECB staff listed as included in the internal Performance Indicators. It was decided that this AECB Staff Performance Indicators survey be service-based for the following reasons:

- Nearly all of the indicated staff were directly involved in the delivery of licensee services,
- Earlier requests from HCA for detailed job descriptions were not forthcoming,
- Telephone interviews with AECB Staff indicated that many were unaware of the business process models provided to HCA
- AECB Staff indicated that their jobs were in a state of flux during the time of these telephone interviews – hampering efforts to generate consistent pictures of "who does what."
- There is an additional point to be made that follows from the above. One respondent suggested that even though the AECB, a specific department or a specific policy might not detail the important job requirements at this time, the AECB Staff themselves could be counted to provide a description of the important tasks currently being performed. In this regard, HCA accepted this feedback from those closest to the task and decided on providing a short list that respondents could fill in. Open-ended questions that invite inflationary self-reports are dangerous. The best way to avoid these and other biases is to ask about the observable measures that show unambiguously that the behaviours are in place. HCA created the "Top Ten" list, complete with the "Show Me" descriptions for each item.
- Different divisions and staff groups within the AECB had markedly different results to share with HCA pertaining to their development of their own internal standards, policies and behavioural expectations. The LAO's for example, had detailed documents that described the LAO activities pertaining to licensees. While these documents were very helpful, they told part of, and not all of, the story pertaining to the evaluations and expectations of LAO work behaviour. In short, it was how the licensees were rated, and not the LAO's although the overlap is considerable.
- Discussions between HCA, inspectors and LAO's indicated a considerable resistance to these parties viewing themselves as service providers. When it was suggested that licence applicants receive information about their application status, to name only one of many examples, the majority of inspectors and LAO's reacted with obvious disdain to sharing or providing information to their clients.

For these and other reasons, it was decided to retain the service-based AECB Staff survey. An additional feature of this approach was a convenient validity check. If AECB Staff rated themselves with the service-based survey, and the licensees rated the same AECB Staff with the same survey, a statement of the differences could be prepared.

Consider the example of an AECB Staff member whose self-rating describes a timely, diligent and effective employee. If the aggregate (or averaged) licensee ratings of that same person paint a divergent picture, the difference is of merit.

The merit does not come from starting "Yes I did. No you didn't" argument, but rather from a rich source for career development. One important starting point in this view would be the realization that successful service delivery contains a large perception component. Successful service

delivery *begins* with the realization that one is providing a service – being within a regulatory body notwithstanding.

The AECB provided a short list of fifteen Staff names, telephone numbers and e-mail addresses. A group e-mail was sent to the members of this list. Another dozen AECB Staff members (not on the provided list) were contacted by telephone.) While the results of the AECB Staff Performance Indicators will be delivered to the AECB under separate cover, a brief presentation of the modal responses to the current survey is listed below.

1. I think I help the consistency of MRD radioisotope activities by:

- Being consistent in my work efforts: All of the time
- Being successful at facilitating the timeliness of AECB tasks: Almost all of the time
- Having a good working knowledge of my job responsibilities: All of the time
- Having above an above average knowledge of the relevant regulations: All of the time
- Applying knowledge of the regulations fairly: All of the time
- Not prejudging any cases I process: All of the time

2. I think I contribute to the service excellence of MRD radioisotope activities by:

- Giving timely notice to others ahead in the work: All of the time
- Providing timely feedback to others later in the work stream: Almost all of the time
- Correcting problems on the spot when appropriate without other supervision: All of the time
- Working with feedback from others to help correct problems cooperatively: All of the time
- Reviewing past problems that are similar to current problems: Almost all of the time
- Working with feedback from others to help correct problems cooperatively: Almost all of the time

3. I think I help the communications aspects of MRD radioisotope activities by:

- Being on time: All of the time
- Being easy to reach by phone: All of the time
- Being easy to reach by fax: All of the time
- Being easy to reach by e-mail: All of the time

There was one respondent who thought that the AECB Staff survey would only yield artificially high self-reports. While self-report inflation bias is an important psychometric issue, it has a lesser importance in the immediate context.

As noted earlier, it was originally suggested by HCA that the radioisotope user population *also* complete the same survey items – only rating the AECB Staff directly. While not a true 360-type survey, looking at these behaviours from both sides yields a number of interesting combinations. The AECB Staff results might valid or invalid. These results might be numerically high or low. The radioisotope user population might endorse the items as being provided or not. The radioisotope user population results might valid or invalid. The "invalid" results would likely be the result of biases arising from existing attitudes towards the AECB in general, towards inspections, or some other AECB elements.

Overall sixteen possible combinations exist (2x2x2x2.) While not approaching any type of combinatorial explosion, there are enough possible scenarios to confuse most readers.

In brief, if the self-report ratings are valid, then the survey shows that the AECB Staff are aware of these service elements for the radioisotope user population. Presumably, the mechanisms and policies thought to be in place to reinforce and drive this behaviour are also successful.

If the self-report ratings are *not* valid, then the survey shows that the AECB Staff are aware of these service elements for the radioisotope user population. Presumably, the mechanisms and policies thought to be in place to reinforce and drive this behaviour are also successful.

Importantly, the question of the validity of these first set of self-report ratings cannot be determined until such time as a complete set of behavioural expectations are fully mapped out, enforceable, and in place.

Validity, in this immediate regard, is a moot point. The real opportunity lies in showing the radioisotope user population that the AECB has introduced the principles of accountability internally and is willing to ask the user population about the success of these attempts at managing accountability.

> As an aside, one point for the reader's consideration might be to imagine what the Staff responses *might* have been, if the Staff had known that their responses could form the content of a user survey about Staff functions.

When the AECB Staff participants were asked to fill in their "Top Ten" list, their responses were fairly straightforward. These responses also included an interesting similarity. The lists *all* started with a description of some manner of "better" licensee or "better" operating site. The middlemost items were largely concerned with policy (internal) items, followed by closing items describing personal and professional development items. One illustrative case is presented below.

> If you ranked the ten most important things you do for radioisotope users (licenses), the first most important thing would be: Licence renewal assessments
> Someone could look at you doing the above task and know you were doing well at it because they would be able to see: Licensees operating in compliance with the regulations
>
> The second most important thing would be: New licence application assessment
> Someone could look at you doing the above task and know you were doing well at it because they would be able to see: A safely operating licensee from the start up of operations
>
> The third most important thing would be: Radiation device approvals
> Someone could look at you doing the above task and know you were doing well at it because they would be able to see: Safe and efficient operating radiation devices in use in Canada
>
> The fourth most important thing would be: Field assessments
> Someone could look at you doing the above task and know you were doing well at it because they would be able to see: Travel statistics, assessment reports, and licensee compliance
>
> The fifth most important thing would be: Communication
> Someone could look at you doing the above task and know you were doing well at it because they would be able to see: Prompt written and oral response to questions and inquiries from staff and licensees
>
> The sixth most important thing would be: Compliance and enforcement
> Someone could look at you doing the above task and know you were doing well at it because they would be able to see: Improved compliance inspections
>
> The seventh most important thing would be: Document production
> Someone could look at you doing the above task and know you were doing well at it because they would be able to see: Production of documents as required and specified

The eighth most important thing would be: Qualified Operator certification program
Someone could look at you doing the above task and know you were doing well at it because they would be able to see: An efficient, cost effective, operating program

The ninth most important thing would be: Approvals and authorizations
Someone could look at you doing the above task and know you were doing well at it because they would be able to see: Decisions made without delay based on knowledge and experience

Finally, the tenth most important thing would be: Personal development and training
How: Someone could look at you doing the above task and know you were doing well at it because they would be able to see: Personal participation and growth to remain current with corporate, industry, and scientific communities

As in the first section of the AECB Staff survey, the responses above should be used to set behavioural targets for compliance behaviours with the AECB Staff. Doing so would ensure the face validity of the targets, represent them as "home grown" and avoid the potential conflict of having the internal Performance Indicators being associated with performance assessments, reviews or appraisals.

Section Five Summary

- This fifth section presented the modal or typical results from a small sample of AECB staff.
- These staff members were surveyed as a pilot for Internal Performance Indicators for the AECB.
- The AECB is clearly attempting to bring consistency to the descriptions of expected workplace behaviours, but that consistency is not yet in place. People were unaware of how to describe their work requirements vis a vis a larger policy description.
- The service-based survey showed that the respondents in this small sample were trying to do their best in their work.
- If these responses are valid, both the standards and results need to be shared with the radioisotope user population.
- Regardless, the *content* of the survey needs to be shared with the radioisotope user population, to reinforce the AECB's attempts to foster improvement internally and for the outside client population.

Section Six: Summary and Recommendations

Summary

HCA was entrusted by the AECB with the responsibility of creating a Performance Indicators prototype.

HCA designed, created and maintained a Performance Indicators prototype for the Atomic Energy Control Board of Canada (AECB.) This work included creating a core set of Performance Indicators for a designated set of risk groups that could also be applied across the entire radioisotope user spectrum. Relevant human performance management elements and attendant psychometric and ratings issues all played a part in this development work. HCA also created and hosted the Web HTML pages to display these developments and related topics.

The survey of radioisotope users strongly indicates that the user population is actively awaiting such a future application and that the web-based dissemination of such a performance management technology will meet an enthusiastic welcome. Subject to the cautionary notes presented in the first section of this report, Performance Indicators should prove to be a pivotal point in the AECB's transition to self-management and accountability for radioisotope users.

HCA is proud to be a part of the development of Performance Indicators. We look forward to helping the AECB in this regard in the future.

To close, HCA wishes the very best to the AECB in their Performance Indicators endeavour.

A set of recommendations from this work is presented below.

Recommendations

1. **Generate specific responsibilities for RSO's, Licensees and Permit Holders**
    - **Description of Problem:**
        - A conceptual stumbling block within this project was the lack of a clear description of specific accountabilities and outcomes for RSO's, Licensees and Permit Holders.
        - Part of this confusion arose from the historical lack of clear or consistent evaluative criteria.
        - This matter was worsened by some radioisotope users' perceptions of bias, their ability to shuffle off or delegate their own responsibilities to someone else, or to shift the blame for poor performance to another person or agency.
        - People with positions of greater responsibility need to recognize the associated accountabilities that are part and parcel of the job perks, title, salary and the like. Put simply, jobs of greater responsibility demand greater accountability. One of the larger definitional problems faced by HCA centered about the position of Radiation Safety Officer. RSO's, it was imagined, were responsible for the training of members within their radioisotope community. With this training responsibility, supposedly came a responsibility for the success of those community members. Successful training was seen to equate with successful performance. The management of the performance of the radioisotope users was seen as a mandate of the RSO.
        - When HCA asked the members of the Performance Indicators development team (who were AECB staff) this confusion about the roles and accountabilities of RSO's was heightened, not diminished. Some reported that the RSO's have the accountability for radioisotope use and others suggested that RSO's were only responsible for promoting a safety culture.

- Again, there is a problem of criterion deficiency. It would appear that RSO's pick and choose their accountabilities.
- Conversations with licensees in applied (not educational or institutional) settings provided a somewhat different, if not more positive response. The notion of accountability has likely been introduced at an earlier date than in non-applied settings. As well, job performance has been more vigorously linked to personal accountability. As one office manager put it, "We know we have to get good inspection grades. Tell us how we get them."

- **Solution:**
  - Generate specific responsibilities within the Performance Indicators framework.
  - Make RSO's *personally* responsible for overall training and safety. Use the same model that the Ministry of Labour uses for Supervisors. This affords for recognition of both due diligence and undue hardship considerations.
  - Link RSO *personal* performance ratings to the overall site rating.
  - Make individual Licensees or Permit Holders specifically responsible for *their own* site, location or lab ratings.

2. **Introduce a "Three Strikes" Approach to Non-Compliance**
   - **Description of Problem:**
     - Radioisotope users know that long-term non-compliance has consequences. Yet almost all of their day-to-day (and perhaps smaller) instances of non-compliance are not taken as seriously.
     - There would seem to be a ready supply of excuses and "work-arounds" that remove or reduce immediate personal responsibility for radioisotope safety.
     - Radioisotope users have a history of not completely sharing or describing the evaluative criteria with those who will be judged by those criteria. The site Licence, conditions and related notes or addenda are not being shared.
   - **Solution:**
     - Ensure that all relevant information about a site is included in that site's Performance Indicators material.
     - Give the responsibility for disseminating this information to the RSO (or person attached to the site.) This information is not meant to be "guarded" by the RSO.
     - Include this information (or relevant portions thereof) in the training package that all people receive prior to beginning work with radioisotope materials.
     - The part of the AECB's transition that involves command decisions and attendant policies of the AECB requires that the Board accept the challenges of:
       - Affixing specific consequences to non-compliance.
       - Creating a set of policy guidelines that determine the consequences for overall non-compliance and the various progressions of poor compliance.
       - Directly link personal and professional accountability to those who have sought positions of responsibility when dealing with radioisotopes.

3. **Make training count**
   - **Description of Problem:**
     - The statement that "Training of radioisotope users is given lip service" is not overly dramatic.
     - The mandate is that "Training shall be delivered," not how or to what level of proficiency.
     - Trainees do not (typically) undergo any mastery or competency testing before being released from training as successful graduates.
     - Drive home the need for accountability during training for radioisotope users. Many users already understand about their own accountability. Others, however, have

expressed considerable trepidation about (their perceptions of) being asked to "do more with less."

- **Solution:**
  - Some manner of assessment to be conducted before training is completed.
  - Establish training guidelines for training with mastery testing before trainees are released from training
  - Training programs need to be consistent and not just follow the core syllabus.
  - Training must be provided in such a means such that the trainees can revisit their training, review their training with the RSO after poor performance or access relevant training information after the training is completed.
  - Other AECB initiatives, again such as target reporting levels, have a considerable training element. Radioisotope users, RSO's and others are likely to voice negative views about this apparent increase in their time demands. Accommodate this training need by offering computer-based training for those who will have accountabilities under the new initiatives.
  - HCA has developed a computer-based radioisotope safety training program that we will gladly share in this endeavour. It would also be logical to include a complete training and introduction application with the final Performance Indicators release.

4. **Standardize many of the reporting and paper-based functions**
   - **Description of Problem:**
     - Radioisotope users must provide certain documentation to the AECB.
     - This includes, but is not limited to annual reports, occurrence reports, and the like.
     - The variability in all of these (usually paper-based) reports and communications pieces is considerable.
     - The variability that has been allowed to develop robs the AECB of a strategic convenience.
     - Radioisotope users should use standard templates and guidelines for such tasks.
   - **Solution:**
     - Provide, as a part of the Performance Indicators application, the Web forms, guidelines or user-completed pages for these reporting and paper-based functions.
     - In our discussions with radioisotope users, HCA was pleased to note that this suggestion met with resounding acceptance.

5. **Provide ongoing Performance Indicators assistance to radioisotope users**
   - **Description of Problem:**
     - Radioisotope users are now largely aware that Performance Indicators will be arriving in one form or another. They also know that a large part of the delivery system will be computer-based.
     - There needs to be a support mechanism in place to assist the radioisotope user population with the new application. This includes sites visits to AECB regional offices to deliver "train the trainer" training and broad support for the user population as a whole.
     - The end user population (including AECB staff) will need an outside, impartial agent to assist them in their progressive understanding of Performance Indicators and the cultural shift that this might represent for their own work style or that of their organization.
     - The position will be used to (initially) foster understanding of the Performance Indicators application and thereafter move on to fostering continuous improvement and higher compliance levels.
   - **Solution:**
     - Create a term or contract position of Performance Indicators Facilitator.

- The tenure of this position will span the development of the Performance Indicators application and perhaps one calendar year after the launch of that application.
- Working as a part of or with, the developer of the Performance Indicators application, the Facilitator will continue to gather feedback from the user population and integrate this feedback into development efforts.
- The position should be able to issue a performance note, similar to the older idea of a "Manager's Note" and submit it to file for the site in question. A Manager's Note was a one page or less description of a task or goal that had to be successfully met by a given time. Nowadays, we might consider this a "To Do" item. A site might be currently experiencing poor ratings and ask the facilitator for assistance. The "to do" item then becomes available to the inspector, client and related staff. This model has worked very successfully in a number of areas, for example, occupational health and safety wherein the organizations' occupational health and safety fees and dues provide funding for the consultant who works with but not for the occupational health and safety agency.

6. **Roll out the Performance Indicators application to those sites who expressed interest in continuing their participation**
   - **Description of Problem:**
     - Delivering a complete Performance Indicators application for all users within Canada in one fell swoop may not be prudent. Testing for data integrity, application robustness and the like will be better served by continuing to field test new application developments with the radioisotope users who have expressed an interest in maintaining direct participation in the Performance Indicators project.
     - This progressive rollout will also help to generate a higher and more favourable profile for the project as participants contribute to greater degrees and the number of participants grows.
   - **Solution:**
     - As part of the ongoing efforts to gather up-to-date information about radioisotope users, specifically ask whether the users would wish to help pilot the application. They would effectively become the "Beta Test Team." In software parlance, "Beta" refers to the "one before initial release" version.
     - The tenure of this position will span the development of the Performance Indicators application and perhaps one calendar year after the launch of that application.

7. **Once the Performance Indicators application rollout is started, make use of logical venues for training and education**
   - **Description of Problem:**
     - Once the Performance Indicators application rollout is started, the AECB needs to increase the profile of its efforts in the eyes of the radioisotope population.
     - The AECB needs to offer future users a *reason* to use Performance Indicators. One could imagine a series of workshops designated to helping users improve their AECB ratings. Helping users plan for progress would be an effort whose rewards would be immediate. The AECB would be seen to be helping. Presented at venues where users already attend, the AECB could avoid having to attend to or nurse all possible users at all possible points of engagement.
   - **Solution:**
     - Some logical venues for early user training and introductions to the Performance Indicators application are:
       - At inspection sites (when the inspectors and LAO's have themselves been trained in the application)
       - At annual conferences of organizations with a radioisotope priority
       - The schools and institutions that teach or offer certification in industrial radiography, health physics, and other areas involved in radioisotope use.

- In HCA's early discussions with training and certification institutions, we asked about their response to a web-based application. They applauded the idea of having access to such a tool early in the professional development of their graduates and students.

8. **Develop the Performance Indicators application as an "out of house" development**
   - **Description of Problem:**
     - The AECB's ability to create and deliver large scale computer applications is constrained by a number of factors. Internal resources, time limits, and existing departmental responsibilities all serve to confound new development efforts.
     - An outside service provider developing the Performance Indicators application can best deliver the application. With obvious and direct contributions from the AECB *and* the radioisotope user population, the outside developer can be seen to facilitate the concerns of all sides while retaining their arm's length neutrality.
   - **Solution:**
     - The Performance Indicators application needs to be developed in collaboration with, but outside of the AECB.
     - It is recommended that the AECB retain HCA to serve as the application developer *and* Performance Indicators facilitator. This would extend the recognition and goodwill that already exist within the radioisotope user population, provide continuity and a logical extension of the support and user education that has already taken place.

9. **Directly address security, browser and "connectedness" issues**
   - **Description of Problem:**
     - The most important features that underlie the Performance Indicators tool are communication and feedback. Yes, people need Internet connections and up-to-date browsers, but above all else they need to feel that the Performance Indicators tools are useful for communication and performance management.
     - Other aspects involved in the development of a web-based application include pragmatic issues such as security, how information will be originally included in the application, layout for graphical feedback elements, responsibility for links to other AECB information. Communications and feedback rise above these other considerations.
     - The development of the Performance Indicators application must also avoid being perceived as a "those with computers only" club.
   - **Solution:**
     - Technically speaking, all radioisotope users in Canada have *at least* some manner of access to the Web. To avoid the perception of an only "those with computers" club, the AECB must be able to provide analog, paper or derivative versions of the application.
     - Providing a paper copy of a final checklist (or access to one) is still a powerful tool. A "fax back" telephone line can automate large parts of this delivery task.

10. **For overall increases in accountability**
    - **Description of Problem:**
      - The AECB has charged itself with the task of increasing the accountability of radioisotope users. This task is difficult at best.
    - **Solution:**
      - Drive home the need for accountability in radioisotope users.
      - When radioisotope users (or attendant others) do not currently have a clear line of accountability, one should be defined.

- Other AECB initiatives, such as target reporting levels, should be linked with Performance Indicators so as to drive home the notion that users are accountable and the AECB is helping.
- Center the Performance Indicators as a helpful tool for user development and introducing the manner in which accountabilities can be met.
- Establish a "three strikes equals you're out" or related policy for failure to meet responsibilities or failing grades on inspections.

11. Performance Indicators for Staff

- **Description of Problem:**
  - Performance Indicators need to be developed for AECB staff.
  - *Which* staff needs to be determined, and for which official groups.
  - This work needs to be conducted at a level of specificity greater than in the current project. Within the current scope, no fewer than four attempts to derive a starting position for Staff Performance Indicators were thwarted by differences in departments, detail of policy and understanding, the lack of recognition of a larger descriptive or classificatory scheme, and the like. Notwithstanding, over sixty separate groups were identified and had evaluation web pages generated.
  - A list of all combinations of staff designations and tasks needs to be outlined. The very large number of web pages generated here would suggest that some tasks can be consolidated within larger groupings
- **Solution:**
  - A more detailed series of job analysis interviews must precede any further development for Performance Indicators for staff.
  - As helpful as materials provided to HCA have been, an going problem with criterion definition needs to be addressed. The AECB needs to state clearly what is expected from each staff member and how these expectations are to be made observable, measurable, non-threatening and non-confrontational. The Staff Performance Indicators can help with this, but any further development work must be cautious of redefining existing work tasks – the developer cannot define the job.
  - Interviews with senior AECB members must be conducted to map out core radioisotope user related tasks and keep the assessment of these tasks separate from other AECB assessments and initiatives. People are busy in a time of change and not deserve to have an outside agent place untoward expectations on their time.

12. Accept the following from HCA

- HCA—Assessment Experts believes that clear intentions and the steps that follow those intentions best express verifiable commitment. To express *our* verifiable commitment to the Performance Indicators vision, HCA will undertake the following:
  - HCA will extend the web-hosting period of the English language version of the Performance Indicators site until September 30, 2000. This will site will be hosted at its current location, but may be moved to an upcoming secure server that is not a part of the ISP server farm where the HCA server box is currently located.
  - HCA has asked that the AECB undertake the French translation of the text portions of the Performance Indicators site and that HCA will also host this site until September 30, 2000. This site is likely to be hosted on HCA's upcoming secure server, given the overall size of the Pilot. As per previous communication from the AECB, HCA will not address translation issues that arise from commercial software.
  - In collaboration with the AECB, we have set the French translation deadline noted above to be the same deadline for editing the Pilot Web page. This editing is required to maintain a professional distance between the AECB and its contractor. This work is already largely completed.
  - HCA will continue to receive, forward, and act upon feedback and suggestions from Radioisotope users until September 30, 2000. As we have done throughout this

project, HCA wishes to ensure that Radioisotope users see their contributions come to fruition in a timely manner.

- HCA has been asked to help with the AECB's Y2K efforts. HCA will continue to solicit survey responses from Radioisotope users until the end of November 1999. At that time, we will forward the list of e-mail addresses to assist with the Y2K efforts.

Appendix A: The Radioisotope User Survey

Performance Indicators Prototype Survey

Eventually available as a web-based resource, this application is being previewed as a set of web pages. The link for these web pages is provided below. **Please note – these pages are best viewed with Microsoft's Internet Explorer 4.x, as available in Microsoft Office.** You can e-mail Dr. Hill and have the link e-mailed to you. His e-mail address is provided under the web page link, below.

Web Page: http://www.hcaassessmentexperts.com/aecb/passfail.htm
E-Mail Address: drtim@hcaassessmentexperts.com

Your mouse click will take you to a start screen with a rotating "Under Construction" image. Please click on this image to continue.

From the start page, you will arrive at a welcome page. This page is divided into three sections, or "frames." The left section runs from the top of the screen to the bottom and is your navigation area. Each dial will change when you place your mouse pointer over it, showing "clickable area" for the link. These links are: Rationale, Sign In, Tutorial, Descriptions, Performance Indicators, Select Your Site and Extra Information. For the purposes of this prototype, you cannot sign in at this time.

Our intention is to show how a web-based tool can:

- Reduce biases and errors in ratings,
- Improve ratings between raters (i.e., you and your Inspector)
- Make clear what the rating expectations are
- Ensure that everyone is working from the same set of rating rules
- Foster continuous improvement in radioisotope safety, and
- Help you manage your radioisotope tasks better, in less time.

Please print clearly when answering the few questions on the next pages.

Thanks!
HCA—Assessment Experts will provide the AECB with updated contact information about your site to help them keep their records up-to-date, so your participation is doubly appreciated!

Performance Indicators Prototype Survey Cover Return page

Please fax to: **HCA—Assessment Experts**
ATTN: AECB Performance Indicators Prototype Survey Response Team

Fax: **519-472-3660**

From: _____
Name of AECB contact person at this site

Fax: _____
Area code, fax number

Voice: _____
Area code, phone number

Some other response options for this survey are...

E-Mail Dr. Hill at drtim@hcaassessmentexperts.com and ask for an e-mail copy of the survey. You don't need to write a message, just ask for an e-mail form in your SUBJECT: line. You can fill in the e-mail form and REPLY with the completed form.

PHONE Dr. Hill at 519-472-4971 and ask for a paper copy to be mailed to you right away.

Performance Indicators Prototype Survey

Some questions about you and your site...

1. Who is your AECB contact person? _____
2. What is this person's voice phone number? _____
3. What is this person's fax phone number? _____
4. What is this person's e-mail address? _____
5. What is the full address for your site?
   6. Street Address _____
   7. City _____
   8. Province _____
   9. Postal Code _____
10. Do you have access to Internet web pages? ◯ Yes ◯ No
11. Which browser do you use at work? _____
    12. Which version? _____
13. Which browser do you use at home? _____
    14. Which version? _____

Some questions about the Performance Indicators Prototype in general...

1. ◯ Yes ◯ No Do you like the idea of reducing rater error(s) by making all Inspectors use the same standard for their evaluations?
2. ◯ Yes ◯ No Do you want to be able click a button to print or download a paper copy of each Performance Indicator (per each AECB Use Type?)
3. ◯ Yes ◯ No Would you rather use a paper version over the web version?
4. ◯ Yes ◯ No Would you want to see ONLY an overall rating from the AECB Inspectors?
5. ◯ Yes ◯ No Would you want to see an overall rating AND specific breakdown ratings from all sites within your location from the AECB Inspectors?
6. ◯ Yes ◯ No Do you think the Performance Indicators tool will be easy to use?

Finding your site in the Performance Indicators Prototype web page...

I'm (usually) in London, so I would click on the Southwestern Ontario area of the map!

1. Click on the rotating "Under Construction" sign in the start screen.
2. Click on the button called "select you site" in the left-hand navigation area.
3. Click on the area of Canada that contains your site. (You can be pretty general here.)
4. You will now have a set of menu options from which you can select your province and then scroll down in that province for your site. Once highlighted, click on the "Go" button.

If you've been to the Performance Indicators Prototype web page...

1. ◯ Yes ◯ No Do you think the Performance Indicators tool will be easy to use?
2. ◯ Yes ◯ No Was the Performance Indicators Prototype web page easy to use?
3. ◯ Yes ◯ No Was it easy to click on map of Canada to find a site to rate?
4. ◯ Yes ◯ No Would it be easier for you to enter your licence number, use type and site address to get to your site?
5. ◯ Yes ◯ No Do you want to be able click a button to print or download a paper copy of each Performance Indicator (per Use Type?)
6. ◯ Yes ◯ No Would you rather use a paper version over the web version?
7. ◯ Yes ◯ No Did you see your hypothetical site ratings and bar charts?
8. ◯ Yes ◯ No Do you want to provide an overall rating based on your inspections -- as opposed to rating all possible sites within the general inspection site?
9. What other information would **you like to see** presented about your site?

10. _____

11. What other information would **you NOT like to see** presented about your site?

12. _____

Some questions about your professional preferences...

1. ⬭ Yes ⬭ No Do you want to be provided with an overall rating based on your AECB's Inspector's ratings -- as opposed to rating all possible sites within the general inspection site?

2. ⬭ Yes ⬭ No Would you like to be able to compare your individual sites within your location to the overall rating?

3. ⬭ Yes ⬭ No Will you use Performance Indicators to show Licensees and Permit Holders where their ratings came from?

4. ⬭ Yes ⬭ No Do you think the use of Performance Indicators will reduce the instances of claims of rater bias?

5. ⬭ Yes ⬭ No Do you think the Inspectors' comments will be helpful to you? (When they provide that feedback through supplemental comments and feedback forms.)

6. ⬭ Yes ⬭ No Do you think it's a good idea for you to have a copy of the **same** rating criteria used by Inspectors?

7. ⬭ Yes ⬭ No Do you like the idea of being able to "pre-rate" yourself so that you know where the evaluation number some from?

8. ⬭ Yes ⬭ No Do you think that Performance Indicators would help you to improve your ratings?

9. ⬭ Yes ⬭ No Would you like to be on our e-mail mailing list to receive news about the progress of the Performance Indicators Prototype?

Appendix B: Navigating the Web Pages from the Performance Indicators Pilot

The "Splash Page" and Introductory AECB Text

Upon loading, the "splash screen" (the artful screen that visitors see first) loads an information window with the following text:

- The Atomic Energy Control Board (AECB) of Canada has mandated the development of performance indicators for its regulatory activities.
- When the Nuclear Safety and Control Act (NSCA) and regulations come into force, the developed performance indicators will be used by the Canadian Nuclear Safety Commission (CNSC).
- HCA - Assessment Experts has been retained by the AECB to help develop some of these performance indicators.
- This web-based prototype has been developed by HCA - Assessment Experts for the Materials Regulation Division (MRD)'s purposes.
- This prototype has been posted here to give AECB licensees (and the public) an opportunity to be aware of the project, to see the work done to-date, to evaluate that work in light of their own experience and circumstances, and to provide feedback and suggestions for improvement.
- On completion of the prototype, HCA - Assessment Experts will submit the work to the AECB for consideration. We welcome your feedback! This prototype is designed to:
  - let licensees know how they will be evaluated and inspected ahead of time by sharing the rules and tools used by AECB inspectors;
  - allow you to do your own practice inspections using the checklists and procedures included in these web pages; and
  - provide a source of information for improvement and a means for getting higher inspection ratings!
- The material presented here is work-in-progress.
- It should not yet be used as a guide to required practice. Do not adjust your operations as a result of the documents presented here.
- The material is being provided for information and consultation purposes only.
- Neither the AECB nor HCA - Assessment Experts assumes any liability for any damages of whatever nature which may result from any person using this prototype in any way other than a preliminary consultation document.
- Please forward your comments to Dr. Timothy D. Hill, at drtim@hcaassessmentexperts.com or at 519-472-4971, by September 30, 1999. All comments will be shared with the AECB.

The text as it appears above was the product of several discussions and iterations between HCA, the AECB and its internal advisors. The above text was not released or entered into the web pages (or other documentation) until final approval had been granted to the text from the AECB. The above text can be viewed at any time in the splash screen by clicking on the words "See The AECB's Message." As well, the bottom frame (portion of the screen that is another HTML window) contains the graphical character for the copyright symbol. This bottom frame remains in view in all windows and the user can revisit the AECB's introductory notice by clicking on the copyright character.

Clicking on the rotating "Under Construction" image or the words "Click here to continue" beneath the image will take the user to the "top" screen. The term "top" screen is used as this is the location that the users are expected to spend most time visiting. It contains the links to all other

aspects of the Performance Indicators Pilot pages. In fact, every page the user might visit contains a "Top" button (in yellow, near the top of their screen) that can immediately take him or her back to a familiar screen. As well, each screen contains a similar yellow "Back" and "About" button that will move the user back one page, or describe the page they're on, respectively.

The Main ("Top") Page

The top page is arranged in the same manner as almost all of the pages in the Performance Indicators Pilot.

The user is presented with a screen comprised of three "frames" or separate HTML sections. These frames are set out in a format similar to a spiral-bound notebook. The navigational frame that runs along the left of the screen (the left of the spiral) contains common links to a number of other pages. The bottom frame is recognizable by the copyright graphic and its link to the AECB's introductory information. The main frame occupies the majority of the user's screen and contains a common set of elements.

Common elements of the navigational frame:

- The name "New User" in red. This originally contained information that was contributed by the user and stored as client side cookies (i.e., in a small text file on the user's computer.) HCA was asked to avoid adding "programs" to AECB computers and to not store any information on those computers as well. The compromise was to leave the name "New User" so that users could see where their name *would* go in a final web-based application.
- Rationale: This link takes the user to a brief description of the rationale for Performance Indicators. While the AECB has entertained Performance Indicators along a number of fronts, it was decided to offer a more generic description to users and hopefully avoid an academic or historical perusal through a varied set of opinions. HCA wished to balance the larger range of contributors to Performance Indicators with the need to present a uniform statement. Therefore, the basics of issues pertaining to Performance Indicators are presented here.
- Sign In: In an earlier version of the Performance Indicators Pilot, users were allowed to enter their information and it would be automatically stored in their own computer. As this ability was withdrawn by the request noted above, HCA amended this page to allow users to send the contents of this form by e-mail. The information is not stored on the users' computers nor on the server retained by HCA.
- Tutorial: This page provides a basic use overview for the Performance Indicators Pilot pages. Several sections are available here for the users. They are: Getting Information in the PI Pilot, Making Ratings in the PI Pilot, Navigating in the PI Pilot, Giving Feedback in the PI Pilot, Supplemental Information in the PI Pilot, Requirements for the PI Pilot
- Descriptions: This provides a brief description of every use type that has an available Performance Indicator rating element. The original intention here was to fully document the relevant Performance Indicator rating elements, but this effort was constrained as the scheduling of the AECB's revisions to the checklists and other AECB documentation was difficult to coordinate. This element remains in the current version to show users that the future web application will contain such information.
- Performance Indicators: As expected, this link takes the user to a page containing links to the Performance Indicators for all use types. While HCA was originally contracted to establish Performance Indicators for those use types that fell into certain risk categories, the project work was facilitated by establishing ratings elements for all use types.
- Select Your Site: This link takes the user to a map of Canada. The user can click on his or her region on the map of Canada and be taken to the menus that correspond to the AECB's breakdown of regional offices and territories. After clicking on the map of Canada, the user can choose the site of interest by making the appropriate selection in a pull-down menu. In a fully implemented web application, only users with certain privileges would be allowed to see certain locations.

- Extra Information: This link leads to the user to a page containing a large number of links that cover alternate formats, a wide range of information, project credits, system requirements, and so on.
- User Survey: This link leads to the user to a page containing an HTML form version of the radioisotope user survey.

Common elements of the main frame:

- The Performance Indicators graphic: Takes the user to an information page to help them navigate the pages.
- The yellow "Back" button: Takes the user back one page in the history of pages visited.
- The yellow "About" button: Pops up a small window to introduce the page.
- The yellow "Top" button: Takes the user to the top screen.
- The red coloured title for the frame.

Appendix C: Extra Information Content Descriptions

General Orientation

- Go to the start: Takes the user to the start page.
- Help: Takes the user to the help page.
- See the sample report feedback... Shows the user a sample feedback page.
- Evaluating "At Risk" Licensees and Permit Holders: Presents a discussion piece of "at risk" licensees and permits holders and notes the important of target levels and early detection (vis a vis Performance Indicators.)
- New checklists! Presents Word, WordPerfect and simple HTML versions of recent checklists from the AECB.
- Welcome to the Performance Indicators Pilot project: Takes the user to the welcome page.
- Radioisotope User Survey (Word document): Takes the user to the Word document containing the radioisotope user survey that was sent by HCA to all 2300 plus users. If Word is enabled on the user's system, the Word document will appear in the main frame.
- Radioisotope User Survey Cover letter (Word document) Takes the user to the Word document containing the cover letter for the above survey. If Word is enabled on the user's system, the Word document will appear in the main frame.
- View a description of the rationale for performance indicators: Takes the user to the Rationale page.
- Select your site from all sites: Takes the user to the clickable image map of Canada that allows them to select their region of Canada and thereby their own location.
- See more detailed information about all pages: Takes the user to a set of page descriptions.
- See the obligations of a Licensee: Takes the user to the AECB's definitions of the obligations of a Licensee.
- See a sample glossary of terms: Takes the user to a glossary of terms created just for the Performance Indicators Pilot project.
- List of Conditions: One of the AECB's deliverables to HCA was to be a complete and authoritative list of all licence conditions. While this list has not been received to date, this page starts this endeavour.
- Hints (This page features pop-out tables) This link takes the user to the table of hints for each use type.
- See a sample data binding page. A page with data binding is one that incorporate dynamic HTML and "builds" the page as it is loaded. Exclusive to Microsoft's Internet Explorer, data binding allows the user to sort columns of data within the page. In this example, HCA created a page that contains all of the permit holder sites within a consolidated licence. The user can sort the permit holders by past scores, room numbers, and the like.
- See a sample information collection page: This link takes the user to a sample (proffered) data entry page that incorporates a larger number of data fields. This was used to show the data fields that would likely be used in a web-based application.
- See the general AECB Procedures (Schedule "D") page: Takes the user to the Procedures page.
- Rate AECB Inspectors: Takes the user to a sample Inspector and LAO rating page. The user can select the Inspector or LAO and rate them on a series of quality of service dimensions.
- See a complete set of use types (Large page, loads somewhat slowly!) Takes the user to a listing of all use types. Arranged by use types, this page lists all 2,300 plus users arranged by use types.
- Sample consumer computing device: An example of a consumer computing device was included to remind AECB members and potential end-users of a (possible) web-based Performance Indicators application that people will use a variety of devices to access web pages and web applications. We have this link to show people an example of a web-aware cellular telephone. Other consumer computing devices include Palm Pilot versions, web TV, handheld PC's, to name but a few.

Sample Performance Indicators Rating and Support

- Preliminary Checklist for Industrial Radiography: This link takes the user to a sample checklist.
- Preliminary Checklist for Nuclear Medicine: This link takes the user to a sample checklist.
- See a proposed example of the web-based database of ratings and feedback: This link was discontinued when client-side cookies were not allowed on user computers. Intended to read from cookies-data and client-side text data files, this page previewed a real-time web database application.
- See an example of 360 degree survey: This link was established as a preview of a format for a 360 degree rating format.
- See the another sample screening and links page. This is another sample client-side database-type page. Created in JavaScript, it searches through a real time data set to find Licensees in various provinces and territories. This main frame is further divided into a top and lower frame in the main window.
- Complete a brief survey: This link takes the user to the first survey sent out by HCA to a very much shorter list of Licensees (as provided by AECB in an earlier pilot project.)
- Submit your permit application: This page will contain information relevant to permit applications and serve as an analog of the paper-based process.
- See your permit application status: This is a page of "dummy" information. Intended to show the progress through a fixed set of steps in the permit application status, various steps are differentiated from others to show past steps achieved, current step, and steps remaining. The purpose behind this simple demonstration was to implore the AECB to allow the permit application process to be more informative, if not transparent, to the applicant. In short, to foster customer service in an organization that may not have viewed itself as a service provider in addition to being a regulatory body.
- Radioisotope Lab Inspection Checklist: This link takes the user to a proprietary HCA tool. It was included in this pilot to show an example of a Performance Indicators-type performance management tool that has been shown to work. In fact, when introduced, this checklist was responsible for bringing a "D" facility to an "A" rating. When its use was discontinued, the "A" rating was lost.

Relevant AECB documentation and links

- Examine the General Procedures documentation
- AECB Operational Procedures (Ch. "D")
- See the relevant sections of the Transport Packaging of Radioactive Materials Regulations
- See the relevant sections of the Transportation of Dangerous Goods regulations
- See the relevant sections of the Atomic Energy Control Regulations

These sections are self-explanatory and will not be elaborated on here.

Reports From HCA

- See the presentation HCA made to the AECB...
- See the complete first report from HCA to the AECB...

Team Credits

- See credits for this project...

System Information and Downloads

- Download the .ZIP file (In Win Zip format
- See the Performance Indicators Newsletter PINS - PI NewS

Information about browsers and system

- About HPMS from HCA

- Information about Netscape Navigator 2
- Information about Netscape Navigator 3
- Information about Netscape Navigator 4.x
- Information about Microsoft's Internet Explorer 3.x
- Information about Microsoft's Internet Explorer 4.x

Appendix D: Further Discussion About Web Security.

Elements of an encryption system:

- The main elements of an encryption system are the plaintext, the cryptographic algorithm, the key and the ciphertext.
- The plaintext is the raw message or data that is to be encrypted.
- A cryptographic algorithm or cipher is a mathematical set of rules that defines how the plain text is to be combined with a key.
- The key is a string of digits.
- The ciphertext is the encrypted message.

These terms are probably best illustrated through a very simple example. If we take the phrase "Web store" and add 2 characters to each letter the phrase becomes "ygd uvqtg". Here:

- "Web store" is the plaintext
- "add x characters to each letter" is the cryptographic algorithm
- "2" is the key
- "ygd uvqtg" is the ciphertext

There are two main types of encryption in common use today: secret-key and public-key.

Secret-key encryption, also known as single-key or symmetric encryption, involves the use of a single key that is shared by both the sender and the receiver of the message.
After creating the message, the sender encrypts it with their key and passes it to the recipient who then decrypts it by using a copy of the same key used to encrypt it.

A widely used method of secret-key encryption is the data encryption standard or DES.
Secret-key encryption does have some limitations, particularly with regard to key distribution. For privacy to be maintained, every transmitter of messages would need to provide a different key to everyone they intended to communicate with, otherwise every potential recipient would be able to read all messages whether it was intended for them or not.

Whilst this is manageable where a small number of parties are involved (for example, sending a private e-mail to a friend) it is not practical for Web commerce which can involve communicating with thousands of customers.

Another limitation with secret-key encryption is its inability to support non-repudiation. As both parties share the same key it is possible for one party to create a message with the shared secret key and falsely claim it had been sent by the other party.

Secret-key encryption on its own is really not suitable for Web commerce or high traffic sites, instead a system known as public-key encryption would be called for.

Public-key encryption, or asymmetric encryption involves the use of two keys, one that can be used to encrypt messages (the public key) and one that can be used to either encrypt them or decrypt them (the private key).

These key pairs can be used in two different ways, to provide privacy or authentication.

Privacy is ensured by encoding a message with the public key as it can only be decoded by the holder of the private key. *Authentication* is achieved by encoding a message with the private key. Once the recipient has successfully decrypted it with the public key they can be assured it was sent by the holder of the private key.

Digital signatures are implemented through public-key encryption and are used to verify the origin and contents of a message.

One advantage of public-key encryption is that the recipient of successfully decrypted message knows that it was sent by the owner of the private key. This is known as *authentication*. However, encrypting messages with a private key is a relatively slow process particularly if the message is a long one. Instead a system of digital signatures is used.

A digital signature is prepared by first passing the message through a one-way cryptographic function to calculate the message digest. This digest is much smaller than the original message

and can be quickly encrypted with the private key to produce a signature which is then added to the original message. The recipient of the digital signature can be sure that the message really came from the sender. And, because changing even one character in the message changes the message digest in an unpredictable way, the recipient can be sure that the message was not changed after the message digest was generated. Authentication can be further strengthened by the use of digital certificates.

Before encrypting and transmitting sensitive information it is important to ensure that the public key being used does indeed belong to the intended message recipient and not someone masquerading as them. One method of doing this is to use a trusted third party or certificate authority (CA). Owners of public keys submit them to a CA along with proof of identity and the CA then digitally signs and issues a certificate which verifies that the public key attached to the certificate belongs to the party stated.

Digital certificates provide the basis for secure electronic transactions as they enable all participants in a transaction to quickly and easily verify the identity of the other participants. Privacy is guaranteed through encryption. Although information can still be intercepted by a third party they will be unable to read them as they have no access to the encryption key. Integrity is also ensured through encryption. If information is received that will not decrypt properly then the recipient knows that the information has been tampered with during transmission.

Authentication is provided through digital certificates. Digital certificates provide the basis for secure electronic transactions as they enable all participants in a transaction to quickly and easily verify the identity of the other participants.

The encryption process: Essentially, SSL is secret-key encryption nested within public-key encryption, authenticated through the use of certificates.

The reason that both secret-key and public-key encryption methods are used is because of the relatively slow speed of public-key encryption compared to secret-key encryption. Initially, the client and server exchange public keys, and then the client generates a private encryption key that is used only for this transaction. This is referred to as a session key. The client then encrypts the session key with the server's public key and sends it to the server. Then, for the rest of the transaction, the client and the server can use the session key for private-key encryption.

An SSL connection is initiated by the client (normally a Web browser) by requesting a document to be sent through the HTTPS protocol as proposed to the standard HTTP protocol.
This is done by by simply prefixing the URL by "https" as opposed to "http". For example:

http://server.domain.com/index.html requests the document index.html be sent through the standard HTTP protocol, whilst https://server.domain.com/index.html requests the same document be sent using the HTTPS protocol which incorporates SSL.

Here in detail are the steps taken during a SSL transaction:

- The client sends a request for a document to be transmitted using the HTTPS protocol by prefixing the URL with "https".
- The server sends its certificate to the client.
- The client checks if the certificate was issued by a Certificate Authority (CA) it trusts. If not, it gives the user the option to continue or to terminate the transaction.
- The client compares the information in the certificate with the information it just received concerning the site: its domain name and its public key. If the information matches, the client accepts the site as authenticated.
- The client tells the server what ciphers, or encryption algorithms, it can communicate with.
- The server chooses the strongest common cipher and informs the client.

- The client generates a private (or session) key using the agreed cipher.
- The client then encrypts the session key using the server's public key and sends it to the server.
- The server receives the encrypted session key and decrypts it with its private key.
- The client and the server then use the session key for the rest of the transaction.

An alternative secure protocol is the Secure Electronic Transaction (SET) protocol developed by Visa and MasterCard specifically for enabling secure credit card transactions on the Internet. Designed for cardholders, merchants, banks and other card processors, SET uses digital certificates to ensure the identities of all parties involved in a purchase. SET also encrypts credit and purchase information before transmission on the Internet.

SET is the Secure Electronic Transaction protocol developed by Visa and MasterCard specifically for enabling secure credit card transactions on the Internet. It uses digital certificates to ensure the identities of all parties involved in a purchase and encrypts credit card information before sending it across the Internet.

SET is exempt from the US cryptographic export restrictions and unlike SSL can therefore use strong, 128 bit encryption for credit card numbers world-wide. In order to gain this exemption, the use of strong encryption has to be limited to the financial information only and does not include other elements of the transaction, for example details of the goods being bought and the delivery address.

Like SSL, SET allows for the merchant's identity to be authenticated via digital certificates. However, SET also allows for the merchant to request users authenticate themselves through digital certificates. This makes it much more difficult for someone to use a stolen credit card. A further advantage of SET is that the merchant has no access to credit card numbers and thus another source of fraud is eliminated.

There are many pilot schemes running using the SET protocol but mainstream adoption has been slower than predicted. The main reasons behind this are the growing acceptance of SSL for secure credit card transactions and the complexity and cost of the SET system.

Encryption Process
In a typical SET transaction, there is information that is private between the customer and the merchant (such as the items being ordered) and other information that is private between the customer and the bank (such as the customer's credit card number). SET allows both kinds of private information to be included in a single, digitally signed transaction.

Information intended for the bank is encrypted using the bank's public key whilst information for the merchant is encrypted with the merchant's public key. This means that the merchant has no access to the credit card details and thus a source of fraud is eliminated.

In addition to this encryption, both sets of information are digitally signed. Finally these two signatures are combined to produce one signature that covers the whole transaction.

There are three parts to the SET system: a software "wallet" on the user's computer; a commerce server that runs at the merchant's Web site; and the payment server that runs at the merchant's bank.

Although future versions of Microsoft's Internet Explorer and Netscape's Navigator will come with SET wallets pre-installed, currently users need to download and install a wallet on their computers. During the installation process the user provides credit card details and obtains user name and PIN to provide secure access to the wallet. The installation process also produces a public and private key for the user. The user also has to obtain a digital certificate from their bank or certificate agency (CA) for each credit card.

To use SET, users select products from the merchant's Web site and then elect to pay via SET by pressing an on-screen button. This automatically starts the wallet program. The user then selects which credit card they wish to use and the wallet and the merchant's server exchange certificates. If these are accepted, the wallet then encrypts and transmits the purchase details to the merchant.

Although the purchase details include the encrypted credit card information, the merchant can not read them. Instead he passes this on to the bank's payment server which debits the users credit card and passes the payment to the merchant.

(With thanks to netsavy.co.uk. for some discussion elements and their graphics included in the above.)

Machine-Readable Proposals

One interesting element in the large discussion about Web security has been the World Wide Web Consortium's (W3C) work-in-progress called the Platform for Privacy Preferences (P3P.) Heralded as a potentially important standard, it was designed to protect consumer privacy and facilitate on-line commerce.

The World Wide Web Consortium (W3C)'s Platform for Privacy Preferences Project (P3P) provides a framework for informed online interactions. The goal of P3P is to enable users to exercise preferences over Web sites' privacy practices. P3P applications will allow users to be informed about Web site practices, delegate decisions to their computer agent when they wish, and tailor relationships with specific sites.

P3P is designed to help users reach agreements with services (Web sites and applications that declare privacy practices and make data requests). As the first step towards reaching an agreement, a service sends a machine-readable proposal in which the organization responsible for the service declares its identity and privacy practices. A proposal applies to a specific realm, identified by a URI or set of URIs. Notice that this privacy proposal enumerates the data elements that the service proposes to collect and explains how each will be used, with whom data may be shared, and whether data will be used in an identifiable manner. The set of statements that may be made in a proposal is defined by the harmonized vocabulary, which is a core set of information practice disclosures. These disclosures are designed to describe what a service does rather than whether it is compliant with a specific law.

Proposals can be automatically parsed by user agents -- such as Web browsers, browser plug-ins, or proxy servers -- and compared with privacy preferences set by the user. Thus, users need not read the privacy policies at every Web site they visit. If a proposal matches the user's preferences, the user agent may accept it automatically. If the proposal and preferences are inconsistent, the agent may prompt the user or reject the proposal.

The procedure in which a service sends a proposal and the user agent accepts or rejects it happens in a flexible manner, sometimes referred to as "negotiation." P3P achieves flexibility by allowing services to offer multiple proposals. For example, a Web site that provides information about movies might offer to supply movie reviews. In addition it provides local movie schedules to visitors who provide their zip codes.

Some P3P implementations support a data repository where users store information they are willing to release to certain services. If they reach an agreement that allows the collection of specific data elements, such information can be transferred automatically from the repository. The P3P specification defines a standard set of base data elements that all P3P user agents should be aware of. It also provides a mechanism that services can use to define new data elements.

Although P3P provides a technical mechanism for ensuring that information is released only under an acceptable agreement, it does not provide a technical mechanism for making sure services act according to their agreements. However, laws and self-regulatory programs can provide enforcement mechanisms. For example, P3P proposals may include reference to an assuring party that may take legal or other punitive action against the service provider if it violates an agreement. TRUSTe is one such organization that has provided Web site privacy assurances, even before the development of P3P. In addition to accountability to an assuring party, services may also be held accountable to industry guidelines and laws.

(With thanks to Joseph Reagle, W3C/LCS/MIT and Lorrie Faith Cranor, AT&T Labs-Research)